North Coast Watershed Assessment Program

Mattole River Watershed Synthesis Report

Appendix F

Assessment of Anadromous Salmonids and Stream Habitat Conditions of the Mattole River Basin

California Department of Fish and Game
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Introduction

The Mattole River Basin encompasses approximately 304 square miles (787 square kilometers) of the northern California Coast Range. Although a small portion of the Mattole's southern-most headwaters lies in Mendocino County, 97.43% of the basin is in Humboldt County. The Mainstem Mattole is approximately 62 miles (100 kilometers) long, and receives water from over 74 tributary streams, including approximately 545 miles (877 kilometers) of perennial stream. The Mattole River enters the Pacific Ocean about 10 miles (16 kilometers) south of Cape Mendocino.

The Mattole Basin contains mostly steep mountainous topography, though the lower section of the Mattole River is characterized by broad flats dominated by large gravel bars (Mattole Restoration Council 1989). Headwater elevations range from 1350 feet (411 meters) at Four Corners to 4087 feet (1246 meters) at Kings Peak. Located less than three miles (4.8 kilometers) from the ocean, Kings Peak is the tallest coastal mountain in California. There are three "post office" towns in the Mattole basin: Whitethorn in the headwaters region, Honeydew near the center of the basin, and Petrolia near the mouth. The resident population in the basin in 2000 was 1,132 people (US Census).

Historically, several species of native salmonid used the Mattole River and its tributaries, including fall-run Chinook salmon, Coho salmon, summer-run steelhead, and winter-run steelhead. A United States Fish and Wildlife Service (USFWS) report estimated populations of 2000 Chinook salmon, 5000 Coho salmon, and 12,000 steelhead in 1960. More recently, a spawner survey conducted in 1994-95 estimated 500 Chinook and Brown et al. (1994) estimated less than 800 adult Coho salmon in the Mattole Basin.

In order to investigate conditions for native salmonids in the Mattole River Basin, the California Department of Fish and Game (CDFG) has examined salmonid presence and habitat through looking at historical records and conducting field surveys. As salmonids are influenced by geology, climate, vegetation and land use patterns, a brief overview of these factors in the Mattole Basin is provided. This overview is followed by a discussion of the issues affecting fisheries resources, the methods the California Department of Fish and Game (CDFG) has used to investigate these issues and the results of these investigations.

Mattole River Basin Overview

Climate

The Mattole has a Mediterranean climate characterized by cool wet winters with high runoff, and dry warm summers with greatly reduced stream flows. Most precipitation falls as rain. Along the coast, average air temperatures range from 46 to 56 degrees F. Further inland, annual air temperatures are much more varied, ranging from below freezing in winter to over 100 degrees in summer. The Mattole basin receives one of the highest annual amounts of rainfall in California. The annual basin averaged rainfall is 81 inches. Average rainfall near the coast in Petrolia is about 50 inches per year and well over 100 inches per year falls near the center of the basin in the Honeydew area. Extreme rain events do occur, e.g. 248.4 inches fell at Bridge Creek near Thorn Junction during 1982-83 (Mattole Restoration Council 1989).

Geology

The Mattole watershed is situated in a geologically complex and tectonically active area, with some of the highest rates of crustal deformation, surface uplift, and seismic activity in North America (Merritts, 1996). Basement rocks, assigned to the Coastal belt and Central belt of the

Franciscan Complex by Irwin (1960) are predominantly structurally-deformed marine sedimentary rocks (McLaughlin and others, 1982, 1983, 1994). The Coastal belt has been divided into three pervasively folded, sheared and otherwise tectonically-disrupted terranes; from northeast to southwest, separated by generally northwest-trending shear zones, are the Yager, Coastal, and King Range terranes (McLaughlin and others, 1997). Late Cenozoic marine and nonmarine deposits (Wildcat Group) underlie a limited area of the watershed west and northwest of Petrolia. Quaternary alluvial deposits cover the bedrock along streambeds in the lower reaches of some tributaries and mainstem Mattole River, while remnants of older surficial deposits are locally preserved on elevated fluvial terraces in some valley areas and on wave-cut terraces along the coast.

Land Use

The Mattole Basin was occupied by Athapaskan-speaking Mattole and Sinkyone Native Americans when the first settlers from the Eastern United States arrived in the early 1850s. Little is known about these Native Americans, as they were quickly displaced by the new settlers. Disputes over hunting ground and domestic stock culminated in a massacre at Squaw Creek in early 1864. Survivors were sent to the Round Valley Reservation in the Middle Fork of the Eel River, where most succumbed to a measles epidemic in 1868 (Mattole Restoration Council 1989).

Good farming and ranching land in the upper Mattole Basin provided opportunities for new settlers, and people moved to the area. More people were drawn with a perceived oil boom in the late 1860s, but stayed as ranchers when the oil failed to materialize (Mattole Restoration Council 1989).

More recently, most of the land use in the Mattole basin is centered on timber harvest, ranching, cattle and sheep grazing, pasture and field crops, and recreation in the King Range National Conservation Area (Mattole Restoration Council 1989).

Many roads were built to gain residential and land use access throughout the basin. A study of the upslope sources of sedimentation in the Mattole Basin carried out by the Mattole Restoration Council in 1989 found that 76% of mapped erosional disturbances were related to roads.

Special Status Species

Ten plant and animal species in the Mattole Basin have been found to have declining populations across their ranges and thus warrant special concern (Table 1). Species with declining populations are eligible to be listed under the federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA) for special attention.

Table 1. Special Status Species of the Mattole Basin.

Major Group	Name	Scientific Name	Federal Listing	State Listing
Plants	Beach layia	*Layia carnosa*	Endangered	Endangered
	Leafy reed grass	*Calamagrostis foliosa*	None	Rare
Fish	Coho salmon	*Oncorhynchus kisutch*	Threatened	Candidate species for listing*
	Chinook salmon	*Oncorhynchus tshawytscha*	Threatened	None
	Steelhead trout	*Oncorhynchus mykiss*	Threatened	None
Amphibians	Foothill yellow-legged frog	*Rana boylii*	Species of concern	Species of special concern
	Tailed frog	*Ascaphus truei*	Species of concern	Species of special concern
	Southern torrent salamander	*Rhyocotriton variegatus*	None	Species of special concern
Birds	Northern spotted owl	*Strix occidentalis caurina*	Threatened	None
	Marbled murrelet	*Brachyramphus marmoratus*	Threatened	Endangered

* The California Fish and Game Commission is scheduled to consider the status of the coho salmon petition in August 2002.

ESA defines an endangered species as any species that is in danger of extinction throughout all or a significant portion of its range. Beach layia is listed as a federally endangered species.

A federally threatened species is any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range. Coho salmon, Chinook salmon, steelhead trout, northern spotted owls, and marbled murrelets are all listed as federally threatened.

Federal species of concern is a is an informal term referring to species that the United States Fish and Wildlife Service believes might be declining or be in need of concentrated conservation actions to prevent decline. Foothill yellow-legged frogs and tailed frogs are federal species of concern.

CESA defines an endangered species as a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease. Beach layia and marbled murrelets are listed as California endangered species.

A California threatened species as a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that, although not presently threatened with extinction, is likely to become an endangered species in the foreseeable future in the absence of the special protection and management efforts required by CESA.

A California candidate species is a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that the California Fish and Game Commission (the commission) has formally noticed as being under review by CDFG for addition to either the list of endangered species or the list of threatened species, or a species for which the commission has published a notice of proposed regulation to add the species to either list. Coho salmon is a candidate species.

California species of special concern have low, scattered, or highly localized populations and require active management to prevent them from becoming California threatened or endangered species. Foothill yellow-legged frogs, tailed frogs, and southern torrent salamanders are California species of special concern.

A California plant species, subspecies, or variety is determined to be rare when, although not presently threatened with extinction, it is in such small numbers throughout its range that it may become endangered if its present environment worsens. Leafy reed grass is a rare plant species.

Fisheries Resources

Fishery resources of the Mattole Basin include fall-run Chinook salmon, coho salmon, summer-run steelhead trout, and winter-run steelhead trout. Other fish present in the Mattole Basin include sticklebacks, lampreys, and sculpins (Table 2). Two notable fish species that have apparently gone extinct in the Mattole Basin are spring-run Chinook salmon (CDFG 1972) and green sturgeon (Moyle et al. 1989).

Table 2: Fish Species in the Mattole River Basin.

Common Name:	Scientific Name:
Anadromous	
Chinook salmon	*Oncorhynchus tshawytscha*
Coho salmon	*Oncorhynchus kisutch*
Rainbow trout	*Oncorhynchus mykiss*
Pacific lamprey	*Lampetra tridentata*
Freshwater	
Coastrange sculpin	*Cottus aleuticus*
Prickly sculpin	*Cottus asper*
River lamprey	*Lampetra ayresi*
Western brook lamprey	*Lampetra richardsoni*
Sacramento sucker	*Catostomus occidentalis*
Threespine stickleback	*Gasterosteus aculeatus*
Marine or Estuarine Dependent	
Pacific staghorn sculpin	*Lepto cottus armatus*
Shiner perch	*Cymatogaster aggregata*
Redtail surf perch	*Amphistichus rhodoterus*
Walleye surf perch	*Hyperprosopon argenteum*
Speckled sanddab	*Citharichthys stigmeus*
Starry flounder	*Platichthys stellatus*
Surf smelt	*Hypomesus pretiosus*
Topsmelt	*Atherinops affinis*

Many fish in the Mattole Basin use the estuary during some part of their life history. Anadromous salmonids and pacific lampreys pass through the estuary on migrations. Threespine stickleback (Busby et al. 1988), pacific staghorn sculpin, prickly sculpin, shiner perch, and topsmelt spawn within the estuary. Juvenile Chinook salmon, some steelhead trout, threespine stickleback (Busby et al. 1988), coastrange sculpin, shiner perch, starry flounder, surf smelt, and topsmelt rear in the estuary.

Recent surveys for coho salmon have determined coho presence in four tributaries in the Eastern Subbasin, seven tributaries and the mainstem Mattole River in the Southern Subbasin, and four streams in the Western Subbasin (Table 3). Recent surveys have also found steelhead trout in five tributaries in the Northern Subbasin, 13 tributaries in the Eastern Subbasin, ten tributaries in the Southern Subbasin, and 13 tributaries in the Western Subbasin.

Table 3. Recent Coho Salmon and Steelhead Trout Presence Surveys in the Mattole Basin.

Subbasin	Stream	2001 Coho Inventory		1990s CDFG Stream Survey Reports	
		Coho Salmon Detected (Y/N)	Steelhead Trout Detected (Y/N)	Coho Salmon Detected (Y/N)	Steelhead Trout Detected (Y/N)
Northern Subbasin	Conklin Creek			N	Y
	McGinnis Creek	N	Y		
	Upper North Fork Mattole River	N	Y		
	Oil Creek	N	Y	N	Y
	Rattlesnake Creek			N	Y
Eastern Subbasin	Dry Creek	N	Y		
	Middle Creek	N	Y	N	Y
	Westlund Creek			N	Y
	Gilham Creek	N	Y	N	Y
	Fourmile Creek	Y	Y	N	Y
	Sholes Creek	Y	Y		
	Harrow Creek	N	Y	N	Y
	Grindstone Creek	Y	Y	N	Y
	Mattole Canyon Creek	N	Y		
	Blue Slide Creek	N	Y		Y
	Box Canyon Creek			Y	Y
	Eubank Creek			N	Y
	McKee Creek	N	Y	N	Y
Southern Subbasin	Bridge Creek	N	Y	Y	Y
	Vanauken Creek	N	Y	N	Y
	Anderson Creek			Y	Y
	Mill Creek (R.M. 56.2)	Y	Y	N	Y
	Baker Creek	Y	Y	N	Y
	Thompson Creek	Y	Y	Y	Y
	Yew Creek	Y	Y	Y	Y
	Upper Mainstem Mattole River	Y	Y		
	Stanley Creek			Y	Y
	Helen Barnum Creek			N	Y
	Lost Man Creek			N	Y
Western Subbasin	Mill Creek (R.M. 2.8)	Y	Y	Y	Y
	Clear Creek	N	Y		
	Indian Creek	N	Y		
	Squaw Creek	N	Y	N	Y
	Granny Creek	N	Y		
	Saunders Creek	N	Y		
	Woods Creek	Y	Y	N	Y
	Honeydew Creek	Y	Y	N	Y
	Bear Trap Creek	N	Y	N	Y
	Bear Creek	N	Y	Y	Y
	Jewett Creek			N	Y
	North Fork Bear Creek			N	Y
	South Fork Bear Creek	N	Y	N	Y
	Nooning Creek			N	Y

Amphibians of Interest

Southern torrent salamanders (Rhyacotriton variegates) and tailed frogs (Ascaphus truei) are two of the amphibian species that inhabit the Mattole Basin (Table 4). Like coho salmon, these amphibians are sensitive to temperature and sediment. However, they live in small, lower order streams, upstream from coho salmon habitat. Therefore, torrent salamander and tailed frog populations can serve as indicators of environmental stresses such as increased water temperature and sediment (Welsh and Ollivier 1998), which are also potential habitat problems for coho salmon.

Table 4. Reptiles and amphibians of the Mattole Basin (Busby et al. 1988).

Common Name	Scientific Name
Reptiles	
Western Fence Lizard	*Sceloporus occidentalis*
Western Skink	*Eumeces skiltonianus*
Northern Alligator Lizard	*Gerrhonotus coeruleus*
Sagebrush Lizard	*Sceloporus graciosus*
Sharp-Tailed Snake	*Contia tenuis*
Racer	*Coluber constrictor*
Common King Snake	*Lampropeltis getulus*
Common Garter Snake	*Thamnophis sirtalis*
Western Rattlesnake	*Crotalus viridis*
Rubber Boa	*Charina bottae*
Ringneck Snake	*Diadophis punctatus*
Pacific Gopher Snake	*Dituophis catenifer*
Western Terrestrial Gartersnake	*Thamnophis elegans*
Western Terrestrial Aquatic Gartersnake	*Thamnophis couchi*
Amphibians	
Pacific Giant Salamander	*Dicamtodon ensatus*
Northern Rough-Skinned Newt	*Taricha granolosa*
Ensatina	*Ensatina eschscholtzi*
California Slender Salamander	*Batrachoseps attenuatus*
Speckle Black Salamander	*Aneides flavipunctatus*
Clouded Salamander	*Aneides ferreus*
Arboreal Salamander	*Aneides lugubris*
Brown North-West Salamander	*Ambystoma gracile*
Southern Torrent Salamander	*Rhyacotriton variegates*
Western Toad	*Bufo boreas*
Pacific Tree Frog	*Hyla regilla*
Red-Legged Frog	*Rana aurora*
Foothill Yellow-Legged Frog	*Rana boylei*
Bull Frog	*Rana cates beiana*
Tailed Frog	*Ascaphus truei*

Torrent salamanders are small amphibians, about two inches from nose to rump. Adults are green or brown colored on top with bright yellow bellies. They are spotted across their entire bodies (CDFG 1994). Torrent salamanders live in clear, cool headwater and lower order streams. They like stream channels in humid forests with large conifers, abundant moss and >80% canopy closure. Torrent salamanders also like loose, coarse substrates with low sedimentation (Welsh and Lind 1996). The life history of torrent salamanders is poorly known. The breeding season is unknown, though eggs loosely placed in cracks in saturated sandstone have been found in December. The embryonic and larval life stages combined are extremely long (4-4.5 years) and reproductive maturity may require 6-7 years or more (CDFG 1994).

Torrent salamanders are sensitive to temperature, moisture, and sediment. Adults are active from 41-50°F, the lowest known air and water temperatures for any aquatic salamander, and have among the lowest critical temperature maximum (82.9°F) of any salamander known. Torrent salamanders may also be the most desiccation intolerant salamander found in California, which is likely related to a high degree of dependence on skin respiration for oxygen exchange (CDFG 1994). Additionally, research has shown that these salamanders are sensitive to fine sediments and substrate embeddedness in streambeds (Welsh and Ollivier 1998).

Tailed frogs are small amphibians, about one inch from nose to rump, with long legs and a large head. Adults are tan or brown in color; though some may be shaded green or red. Adult males have an external copulatory organ, which gives the species its name. Tailed frogs live in clear, cool mountain streams. They like small channels without fish and with shading vegetation. Tailed frogs also like streams with large stones, cobbles, and stable boulders, which they can use for shelter from the rapid current. Some quieter side pools are also needed, so that eggs and hatchlings won't be washed away. Additionally, the streams must flow year round, since tailed frog tadpoles need to stay in the stream for a long growth period. Tailed frogs breed from May through September, and females deposit their eggs in strings under rocks in fast-moving streams. Larvae take 1 to 4 years to metamorphose and have a distinct round mouth modified for suction to streamside rocks. Adults may live 15 to 20 years, making them one of the longest-lived frogs in the world (CDFG 1994).

Tailed frogs are sensitive to stream temperatures and sediment. Tail frog egg development cannot occur in streams with temperatures above 65.3°F, one to two year old tadpoles prefer stream temperatures of 41-46.4 °F, two to three year old tadpoles prefer stream temperatures of 53.6-60.8°F, and the lethal temperature maximum for adults is 73.4-75.2°F (CDFG 1994). Welsh (1990) found higher numbers of tailed frogs in streams with lower temperatures.

Welsh et al. (2002) conducted a study to determine the linkages between landscape processes and torrent salamanders and tailed frogs in the Mattole Basin. They surveyed 49 stream reaches for amphibians from 1994-1996, eleven in the Northern Subbasin, six in the Eastern Subbasin, 15 in the Southern Subbasin, and 17 in the Western Subbasin (Figure 1). At each surveyed stream reach, the seral stage of the stream canopy was also determined. Torrent salamanders were found in eleven stream reaches and tailed frogs were found in15 stream reaches.

No torrent salamanders were found in Northern Subbasin surveyed stream reaches, while tailed frogs were found in four reaches. Neither species of amphibian was found in surveyed stream reaches in the Eastern Subbasin. The Southern Subbasin had torrent salamanders in three surveyed stream reaches and tailed frogs in three additional surveyed stream reaches. The Western Subbasin also had occurrences of both torrent salamanders and tailed frogs. Five surveyed stream reaches contained both species of amphibian, two reaches only contained torrent salamanders, and two reaches only contained tailed frogs.

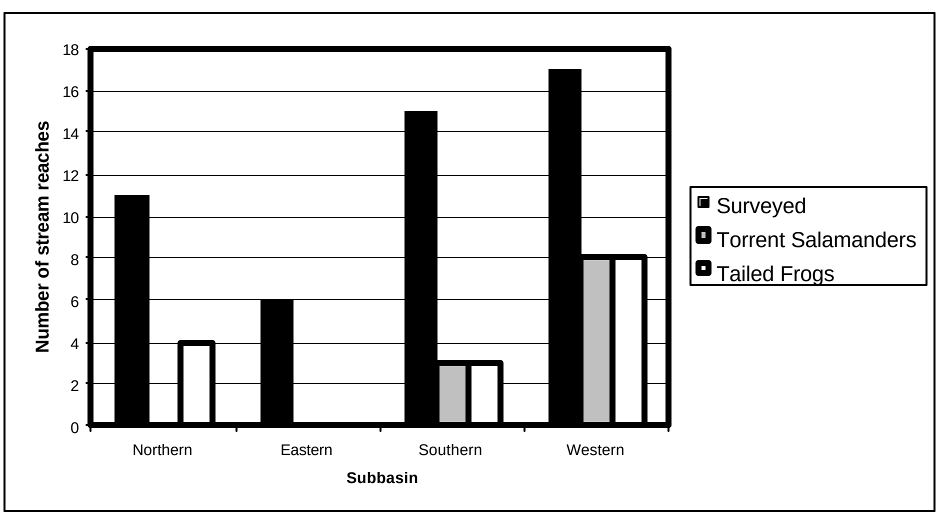


Figure 1. The number of surveyed stream reaches containing torrent salamanders and tailed frogs in each subbasin of the Mattole Basin (Data from Welsh et al. 2002).

When the occurrence of torrent salamanders and tailed frogs in stream reaches was examined in terms of the seral stage of the stream canopy, torrent salamanders and tailed frogs were abundant in late seral forests, less common in second growth forest habitats, and not found in mixed forest/grassland ecosystems in the Mattole Basin (Figure 2). For more information on Redwood Sciences Laboratory current research about amphibians in the Mattole Basin, visit their website at http://www.rsl.psw.fs.fed.us/projects/wild/herpwebpage/index.html.

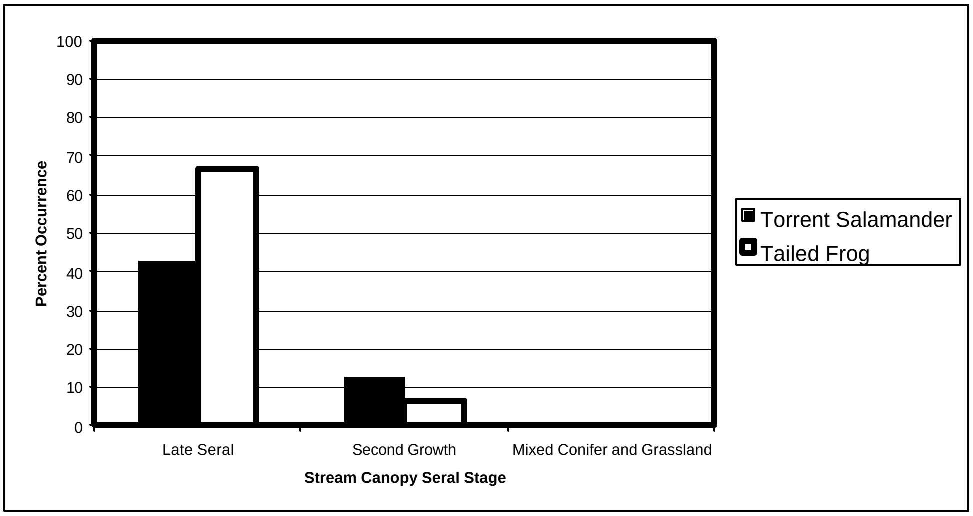


Figure 2. The percent occurrence of torrent salamanders and tailed frogs in stream reaches with late seral, second growth, and mixed conifer and grassland canopy in surveyed stream reaches in the Mattole Basin (Data from Welsh et al. 2002).

Anadromous Salmonid Natural History

Chinook Salmon

Mattole River Chinook salmon are fall-run, migrating into the river as adults from October through February and spawning during the same period. Shortly after fry emerge from redds, gravel incubation nests built by spawning females, they begin to move downstream and arrive at the estuary throughout the spring. In California, most Chinook smolts enter the ocean during their first seven months of life. Chinook salmon generally mature at 3 to 4 years of age. Some precocious males mature at age 2 (commonly called "jacks") and return to spawn and die along with the older, larger fish.

Chinook salmon generally spawn in swift, relatively shallow riffles or along the edges of fast runs where there is an abundance of loose gravel. The females dig spawning nests (redds) in the gravel and deposit their eggs in the redd. Eggs are immediately fertilized by a male and covered with gravel by the female. The adults die within a few days after spawning. Water flows through the gravel and supplies oxygen to the developing embryos. An average female Chinook salmon produces 3,000-6,000 eggs depending on the size of the fish.

Chinook salmon select spawning sites within narrow ranges of water velocity and depth. Spawning requires well oxygenated, cool water. Velocity is generally regarded as a more important parameter than depth for determining the suitability of a particular spawning site. The velocity determines the amount of water which will pass over the incubating eggs. Depths under six inches can be physically prohibitive for spawning activities. In general, optimum spawning velocity is 1.5 feet per second (fps), ranging from 1.0 to 3.5 fps. Salmon exhibit differences in preferred depths for spawning based on watershed. Mattole River fall-run Chinook typically spawn at depths ranging from 1-5 feet.

Substrate composition is another critical factor in determining the suitability of spawning site selection. For successful reproduction, Chinook salmon require clean and loose gravel that will remain stable during incubation and emergence. Average size of Chinook salmon redds ranges from 75 to 100 square feet. In areas where spawning activity is high, redds of later spawners may be dug adjacent to, or super-imposed upon, earlier redds and some egg disturbance may occur. The territory required for pre-mating activity has been estimated to be between 200 and 650 square feet for a pair of salmon but this varies widely according to population density. Where spawning occurs throughout a protracted spawning season, as many as three or four redds may be dug in the area equivalent to the territorial requirement of one pair.

In general, the substrate chosen by Chinook salmon for spawning is composed mostly of gravels from 0.5 to 5 inches in diameter with smaller percentages of coarser and finer materials with no more than about 5 percent fines. Although some spawning will occur in sub-optimal substrates, incubation success will be lower. Substrate composition must be low in sand and silt so that oxygenated water is allowed to freely permeate and flow through intra-gravel spaces, and to allow newly hatched salmon to move up through the gravel into the water column. Sediments deposited on redds can reduce water flow through the gravel and suffocation of eggs or newly hatched fry may occur. Gravel is completely unsatisfactory when it has been cemented with clays and other fines, or when sediments settle out and cover eggs during the spawning and incubation period.

The preferred temperature for Chinook salmon spawning is generally 52°F with lower and upper threshold temperatures of 42°F and 56°F. Holding adults prefer water temperatures less than 60°F, although, acceptable temperatures for upstream migration range from 57°F to 67°F.

In the Mattole River system, Chinook salmon eggs usually hatch in 40 to 60 days, and the young "sac fry" usually remain in the gravel for an additional 30 days until the yolk sac is nearly entirely absorbed. The rate of development is faster at higher water temperatures. Significant egg mortalities can occur at temperatures in excess of 57.5°F with total mortality normally occurring at 62°F.

After emergence, Chinook salmon fry attempt to hold position in the water column and feed in low velocity slack water and back eddies. They move to somewhat higher velocity areas as they grow larger and make their way to the estuary. In the Mattole River system Chinook salmon juveniles are detained in the estuary because of the creation of lagoon conditions early in the summer. This prevents them from going to the ocean until it reopens in Fall. Unfortunately, conditions in the estuary through the summer are not hospitable and studies conducted by Humboldt State University within the past fifteen years have shown high, and perhaps total, mortality in some years. Juveniles that enter the ocean and survive to adulthood, usually return to the system after their third or fourth year at sea.

Coho Salmon

Coho salmon adults enter the Mattole River from October through December and reach the upper spawning reaches in November and January. In the shorter California coastal streams, most return from mid-November through mid-January. Spawning commences shortly after arriving at the spawning sites provided that water conditions, including flow and temperature are satisfactory.

Redd construction behavior is similar to that displayed by other salmonid species, with the female excavating a depression in the gravel by turning on her side and using her body and tail to displace gravel downstream.

The number of eggs produced by the female is directly related to her size. Four-pound and ten-pound females produce about 2,000 and 2,700 eggs, respectively. Under optimum conditions, most eggs will hatch.

The amount of time required for the incubation of coho eggs varies primarily with water temperature. Normally, four to eight weeks are required for incubation. Another two to seven weeks are required before fry hatch and emerge from the gravels (Shapovalov and Taft, 1954). Mortalities during this period can vary substantially. Under optimum conditions, mortalities can be as small as ten percent. However, under very adverse conditions such as scouring flows or heavy siltation, close to a complete loss may occur. Shapovalov and Taft (1954) estimated that under favorable conditions (in the absence of heavy silting) survival to emergence in Waddell Creek (Santa Cruz) was between 65 and 85 percent of the eggs deposited.

Juvenile coho will normally attempt to remain in the stream, in the vicinity where hatched, for one year. However, environmental factors, such as low summer flows or high water temperatures, or population pressures due to limited rearing space and food, will force the smaller, weaker individuals to relocate. Most of this movement is manifested in a downstream migration of fry during the first spring and summer.

Smoltification, which is the physiological change adapting young anadromous salmonids for survival in saltwater, normally occurs in California coho during the spring of the fish's second year. In recent downstream migrant studies on several Mendocino County streams and on Lagunitas Creek, juvenile coho emigrating from the streams ranged in size from 2.5 to 8 inches fork length indicating age 0+ and age 1, and averaged approximately 4.5 inches (Bratovich and Kelley, 1988; W. Jones, pers. comm.).

Coho typically spend two growing seasons in the ocean and return to spawn near the end of their third year of life. However, some males return to spawn near the end of their second year. Nearly all are precocious males (jacks) which, like their adult counterparts, die after spawning.

Steelhead Trout

Steelhead trout are an anadromous strain of rainbow trout that migrate to sea and later return to inland rivers as adults to spawn. In contrast to all Pacific salmon, not all steelhead die after spawning. Upstream migration occurs from November through May with the peak run occurring in January-February. Mattole River steelhead spawners are typically age four or five years and weigh 2 to 12 pounds or more. Female steelhead carry an average of 3,500 eggs, with a range of 1,500-4,500.

Like other salmonids, steelhead prefer to spawn in clean, loose gravel and swift, shallow water. Gravel from the redd excavation forms a mound or tail-spill on the downstream side of the pit. Eggs deposited along the downstream margin of the pit are buried in the gravel as excavation proceeds. An average of 550-1,300 eggs are deposited in each redd. The males fertilize the eggs as they are deposited. Water flowing through the gravel supplies oxygen to the developing embryos.

Water depth and velocity criteria for spawning and rearing steelhead differ slightly from those for salmon. Spawning velocity appears to be about the same as for Chinook salmon, 1.5 fps, but depth is slightly less, to about 0.75 foot. Gravel particle sizes selected by steelhead vary from about 0.25-3.0 inches in diameter, somewhat smaller than those selected by Chinook salmon.

Steelhead eggs seem less tolerant of fine sediment than Chinook salmon, probably because eggs are smaller and oxygen requirements for developing embryos are higher. A positive correlation has been demonstrated between steelhead egg and embryo survival and the rate of water flow through the gravel. Egg survival is highly dependent upon the flow of well oxygenated water. The average size of a steelhead redd is smaller than that of a Chinook salmon. Redd sizes range from 22.5 to 121 square feet and average 56 square feet.

All freshwater life stages of steelhead, except rearing, require lower temperatures than Chinook salmon. The preferred temperatures for steelhead are between 50°F and 58°F, although they will tolerate temperatures as low as 45EF. Studies show that the upper preferred temperature limit for rainbow trout in Sierra Nevada streams is 65°F. The temperature range for spawning is somewhat lower, ranging from 39-55°F, and the preferred incubation and hatching temperature is 50°F. During the egg's tender stage, which may last for the first half of the incubation period, a sudden change in water temperature may result in increased mortality.

Egg incubation in the Mattole River system takes place from December through April. The rate of embryo development is a function of temperature with higher temperatures contributing to faster development. At 50°F, hatching occurs in 31 days; at 55°F hatching occurs in 24 days.

Newly hatched sac fry remain in the gravel until the yolk sac is completely absorbed, a period of 4-8 weeks. Emergence is followed by a period of active feeding and accelerated growth. The diet of newly emergent fry consists primarily of small insects and invertebrate drift. As they grow, fry move from the shallow, quiet margins of streams to deeper, faster water.

Unlike juvenile fall-run Chinook salmon, which typically emigrate within 3 to 4 months after emerging from the gravel, juvenile steelhead usually remain in fresh water for two years. Because rearing steelhead are present in fresh water all year, adequate flow and temperatures are important to the population at all times.

Generally, throughout their range in California, steelhead that are most successful in surviving to adulthood spend at least two years in fresh water before migrating downstream. In the Mattole River, steelhead generally migrate downstream as 2-year old smolts during spring and early summer months. Emigration appears to be more closely associated with size than age, 6-8 inches being the size of most downstream migrants. Downstream migration in unregulated streams has been correlated with spring freshets.

Summer Steelhead Trout

(Adapted from Jones and Ekman, 1980.) Summer steelhead enter the Mattole River between March and June. Fish remain in clear, cool, deep pools until late winter and spring of the following year before spawning. Mattole River summer steelhead can be large in size, averaging 26 inches and 24 inches, or more for males and females respectively. Egg deposition occurs in early spring with the young hatching about 50 days later. Young steelhead generally remain in the Mattole River for two years followed by another one to three years of ocean life before returning to complete their life cycle. Ninety percent of the returning adults are three and four year old fish.

Issues Affecting Fisheries Resources

Chinook salmon, coho salmon, and steelhead trout all utilize headwater streams, larger rivers, estuaries and the ocean for parts of their life history cycles. There are several factors necessary for the successful completion of an anadromous salmonid life history.

A main component of the NCWAP is the analyses of these factors in order to identify whether any of them are at a level that limits production of anadromous salmonids in North Coast watersheds. This "limiting factors analysis" (LFA) provides a means to evaluate the status of a suite of key environmental factors that affect anadromous salmonid life history.[1] These analyses are based on comparing measures of habitat components such as water temperature and pool complexity to a range of reference conditions determined from empirical studies and/or peer reviewed literature. If the component's condition does not fit within the range of the reference values, it may be viewed as a limiting factor. This information will be useful to identify the underlying causes of stream habitat deficiencies and help reveal if there is a linkage to watershed processes and land use activities.

Freshwater Environment

In the freshwater phase in salmonid life history, stream connectivity, stream condition, and riparian function are essential for survival. Stream connectivity describes the absence of barriers to the free instream movement of adult and juvenile salmonids. Free movement in well-connected streams allows salmonids to find food, escape from high water temperatures, escape from predation, and migrate to and from their stream of origin as juveniles and adults. Dry or intermittent channels can impede free passage for salmonids; temporary or permanent dams, poorly constructed road crossings, landslides, debris jams, or other natural and/or man-caused channel disturbances can also disrupt stream connectivity.

Stream condition includes several factors. They include adequate stream flow, suitable water quality, suitable steam temperature, and complex habitat. For successful salmonid production, stream flows should mimic the natural hydrologic regime of the watershed. A natural regime minimizes the frequency and magnitude of storm flows and promotes better flows during dry periods of the water year. Salmonids evolved with the natural hydrograph of coastal watersheds, and changes to the timing, magnitude, and duration of low flows and storm flows can disrupt the ability of fish to follow life history cues. Adequate instream flow during low flow periods is essential for good summer time stream connectivity, and is necessary to provide juvenile salmonids free forage range, cover from predation, and utilization of localized temperature refugia from seeps, springs, and cool tributaries.

Three important aspects of water quality for anadromous salmonids are water temperature, turbidity, and sediment load. In general, suitable water temperatures for salmonids are between 48° and 56° F for successful spawning and incubation, and between 50-52° and 60-

1 The concept that fish production is limited by a single factor or by interactions between discrete factors is fundamental to stream habitat management (Meehan 1991). A limiting factor can be anything that constrains, impedes, or limits the growth and survival of a population.

64° F, depending on species, for growth and rearing. Additionally, cool water holds more oxygen, and salmonids require high levels of dissolved oxygen in all stages of their life cycle.

A second important aspect of water quality is turbidity, which is the relative clarity of water. Water clarity and turbid suspended sediment levels affect nutrient levels in streams that in turn affect primary productivity of aquatic vegetation, and insect life. This eventually reverberates through the food chain and affects salmonid food availability. Additionally, high levels of turbidity interfere with juvenile salmonids' ability to feed and can lead to reduced growth rates and survival (B. Trush, personal communication).

A third important aspect of water quality is stream sediment load. Salmonids cannot successfully reproduce when forced to spawn in streambeds with excessive silt, clays, and other fine sediment. Eggs and embryos suffocate under excessive fine sediment conditions because oxygenated water is prevented from passing through the egg nest, or "redd." Additionally, high sediment loads can "cap" the redd and prevent emergent fry from escaping the gravel into the stream at the end of incubation. High sediment loads can also cause abrasions on fish gills, which may be susceptible to infection. At extreme levels, sediment can clog the gills causing death. Additionally, materials toxic to salmonids can cling to sediment and be transported through the downstream areas.

Habitat complexity for salmonids is created by a combination of deep pools, riffles, and flatwater habitat types. Pools, and to some degree flatwater habitats, provide escape cover from high velocity flows, hiding areas from predators, and ambush sites for taking prey. Pools are also important juvenile rearing areas, particularly for young coho salmon. They are also necessary for adult resting areas. A high level of fine sediment fills pools and flatwater habitats. This reduces depths and can bury complex niches created by large substrate and woody debris. Riffles provide clean spawning gravels and oxygenate water as it tumbles across them. Steelhead fry use riffles during rearing. Flatwater areas often provide spatially divided "pocket water" units that separate individual juveniles which helps promote reduced competition and successful foraging (Flosi, et al., 1998).

A functional riparian zone helps to control the amount of sunlight reaching the stream, and provides vegetative litter and invertebrate fall. These contribute to the production of food for the aquatic community, including salmonids. Tree roots and other vegetative cover provide stream bank cohesion and buffer impacts from adjacent uplands. Near stream vegetation eventually provides large woody debris and complexity to the stream (Flosi et al. 1998).

Riparian zone functions are important to anadromous salmonids for numerous reasons. Riparian vegetation helps keep stream temperatures in the range that is suitable for salmonids by maintaining cool stream temperatures in the summer and insulating streams from heat loss in the winter. Larval and adult macroinvertebrates are important to the salmonid diet and they are in turn dependent upon nutrient contributions from the riparian zone. Additionally, stream bank cohesion and maintenance of undercut banks provided by riparian zones in good condition maintains diverse salmonid habitat, and helps reduce bank failure and fine sediment yield to the stream. Lastly, the large woody debris provided by riparian zones shapes channel morphology, helps a stream retain organic matter and provides essential cover for salmonids (Murphy and Meehan 1991).

Therefore, excessive natural or man-caused disturbances to the riparian zone, as well as the directly to the stream and/or the watershed itself can have serious impacts to the aquatic community, including anadromous salmonids. Generally, this seems to the case in streams and watersheds in the north coast of California. This is borne out by the recent decision to include many North Coast Chinook and coho salmon, and steelhead trout stocks on the Endangered Species Act list.

Depressed populations of salmonids are at a higher risk of serious impacts from predation. Predators of juvenile salmonids in the freshwater habitat include birds such as herons and mergansers, otters, snakes, and larger fish. Adequate escape cover in the freshwater habitat provides salmonids with some protection from these predators.

Estuarine Environment

Estuaries are critical habitats for all anadromous salmonids. Estuaries provide the connection between freshwater and marine environments through which salmonids pass as juveniles during seaward migrations and as adults during spawning migrations. Estuaries are also recognized as valuable salmonid nursery areas because their ocean connection helps provide abundant food supplies, diverse habitat, and relative security from predators. Fish that utilize estuaries for an important part of their life cycle, such as salmonids, are referred to as estuarine-dependent.

During seaward migrations, all juvenile Chinook salmon, coho and steelhead utilize at least a brief estuarine residence while they undergo physiological adaptations to salt water and imprint on their natal stream. Juvenile salmonids may also extend their estuarine residency to utilize the sheltered, food rich environment for several months or a year before entering the ocean. Studies have revealed that juvenile salmonids utilizing estuaries for three months or more return to their natal stream at a higher rate than non-estuarine reared members of their cohort (Riemers 1976, Nicholas and Hankin). Estuarine reared salmonids may be at an advantage because they enter the ocean at a larger size or during more favorable conditions. Entering the ocean at a larger size may be advantageous by allowing juvenile salmonids to avoid predation or increasing the amount of prey items that can be used for food.

Estuarine rearing is a strategy that adds diversity to juvenile salmonid life history patterns and increases the odds for survival of a species encountering a wide range of environmental conditions in both the freshwater and marine environments. Additionally, an extended estuarine residency may be especially beneficial for salmonids from rivers where low summer flows or warm water temperatures severely limit summer rearing habitat. Benefits are dependent upon the estuary retaining its connection with cool, nutrient laden seawater.

High levels of estuarine filling with sediment transported from upper watersheds through periodic flooding can reduce estuary volume and alter the physical and biologic function of the estuarine ecosystem and adjacent wetlands. Alterations include elevated summer water temperatures and loss of habitat complexity. A loss of habitat complexity reduces salmonid refugia from high summer water temperatures, low dissolved oxygen, and avian predators.

Salmonids are also at risk for sea lion and seal predation when they cross through estuaries on their spawning migration. Sea lion and seal populations off the coast of California have been increasing since the enactment of the Marine Mammal Protection Act in 1972. These sea mammals are opportunistic feeders and will eat salmonids when available (CDFG 2002). Local residents have expressed concern about sea lion predation on salmonids in the Mattole Estuary (Public Meeting 2002). Although no studies of predation in the Mattole Estuary have been conducted, numerous studies of sea lion and seal food preferences and predation upon salmonids throughout the Pacific Northwest exist.

Studies dating back to the 1900s have looked at the proportion of sea lion and seal diets that is composed of salmonids. Sea lions and seals utilize a wide range of food resources, including salmonids (CDFG 2002). However, examinations of the stomach contents of hunter-killed seals and sea lions in the early 1900s rarely showed signs of salmon (Bokin et al. 1995). California sea lions at the mouth of the Russian River were also found to forage minimally on anadromous salmonids (Hanson 1993). A dietary analysis of California sea lions at the mouth of the Klamath River found that lampreys were the main prey item and that 1-8% of diet samples included salmon (Bowlby 1981). Additionally, an analysis of the relative abundance of salmonid remains in sea lion and seal scat at the Smith, Mad, and Eel rivers found the relative abundance to range from 0.2-1.6% (Goley and Gemmer 2000). In general, salmonids appear to be a minor component of the diet of marine mammals (Scheffer and Sperry 1931, Jameson and Kenyon 1977, Graybill 1981, Brown and Mate 1983, Roffe and Mate 1984, Hanson 1993, Bokin et al. 1995, Goley and Gemmer 2000, Williamson and Hillemeier 2001a, 2001b).

Studies have also been conducted to examine the impact of sea lion and seal predation on salmonid populations. Sea lions and seals at the Rogue River in Oregon were found to take less than 1% of the returning adult summer steelhead (Roffe and Mate 1984). Harbor seals in the Klamath River Estuary were observed to prey upon salmonids during CDFG tagging operations; however, little or no predation occurred on days when no seining occurred. The estimated percentage of tagged fish taken by seals ranged from 3-8%, with the majority of fish taken by as few as 12 seals (Hart 1987, Stanley and Shaffer 1995). A recent study at the Klamath River estuary estimated that California sea lions, Pacific harbor seals, and Steller sea lions combined ate 2.3-2.6% of fall run Chinook salmon entering the Klamath estuary (Williamson 2002). Therefore, it appears that the relative impact of sea lion and seal predation upon salmonids is small.

Sea lions and seals are a part of the natural environment in which salmonids have evolved. Although salmonids appear to constitute only a small part of sea lion and seal diets, the impact on salmonid populations could still be significant. In fact, when salmonid population levels are low, other prey are absent, and physical habitat conditions lead to the crowding of adult and juvenile salmonids into small areas, even low rates of predation by sea lions and seals can have an impact (CDFG 2002).

Marine Environment

Anadromous salmonids spend most of their life cycle in the ocean. Climate-driven variability in marine water temperature and ocean upwelling are two important factors that affect the availability of nutrients for production of plankton, which in turn affects food availability for salmonids. Changes in water temperatures also lead to changes in species composition, creating variability in the type and abundance of predators and competitors of salmon.

Another important factor affecting salmonids in the ocean is commercial and recreational fishing. During periods of decreased habitat availability, the impacts of recreational fishing on native anadromous stocks may be heightened. Commercial fishing on unlisted, healthier stocks has caused adverse impacts to weaker stocks of salmon, and illegal high seas driftnet fishing and mid-water trawl fisheries in past years may have also been partially responsible for declines in salmon abundance. However, such fisheries cannot account for the total reductions in salmon abundance in North America (NMFS 2000).

Salmon fishing has been important in California since settlement by Native Americans. Salmon were an important part of the diet of native peoples along the Pacific coast as well as a product for bartering. It is estimated that Native American salmon harvest in the Central

Valley may have exceeded 8.5 million pounds a year. Traditional fishing methods included gill nets, dip nets, fishing spears, and communal fish dams (CDFG 2002).

The arrival of gold miners in California in 1850s drove the start of commercial fishing in California, and the opening of the first cannery on the Pacific Coast in 1864 on the Sacramento River quickly intensified fishing efforts. Commercial fishing reached a peak in 1882 when 12 million pounds of salmon were caught. Increased salmon landing combined with stream degradation by mining pollution, agriculture, and timber operations caused salmon stocks to collapse. The last cannery was shut down in 1919, and the last inland commercial fishing area was closed in 1957 (CDFG 2002).

Commercial ocean troll fishing began in California during the 1880s. The fishery grew to approximately 200 boats by 1916 and expanded north to Fort Bragg, Eureka, and Crescent City. Technology improved, salmon stocks rebounded, and the fleet grew to 1,100 vessels in 1947, and 5,000 vessels in the 1970s (CDFG 2002).

CDFG began systematic sampling of commercial ocean salmon landings in 1952 (Figure 3). During the 1960s and 1970s, salmon harvests were high and consistent. The following two decades produced more variable catches. The largest commercial landings occurred in 1988 when 14.4 million pounds of Chinook salmon were landed and 319,000 pounds of coho salmon were landed. The lowest commercial landings occurred in 1992, an El Niño year, when 1.6 million pounds of Chinook salmon were landed and 11,300 pounds of coho salmon were landed (CDFG 2002).

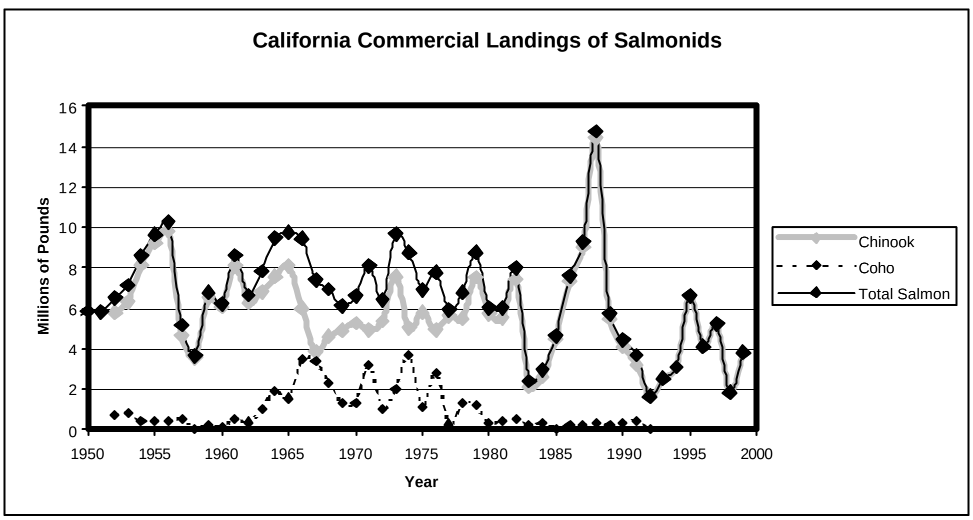


Figure 3. Commercial landings of salmon in California from 1952-1999.

Catch data includes salmon taken in the ocean, and coastal rivers including the Sacramento River. The Sacramento commercial fishery closed after 1959. Coho were no longer permitted for take after 1992. Data from CDFG Catch Bulletins and commercial landing receipts as reported in California's Living Marine Resources: A Status Report.

The development of the commercial passenger fishing vessel industry after World War II popularized ocean sport fishing for salmon and CDFG started monitoring recreation landings in 1962 (Figure 4). Sport industry contributions to the total annual salmon catch in California increased from 17% to 31% in the 1990s due to increased regulation of commercial fishing. The largest sport landings occurred in 1995 when 398,100 salmon were landed and the lowest sport landings occurred in 1999 when 88,300 salmon were landed (CDFG 2002).

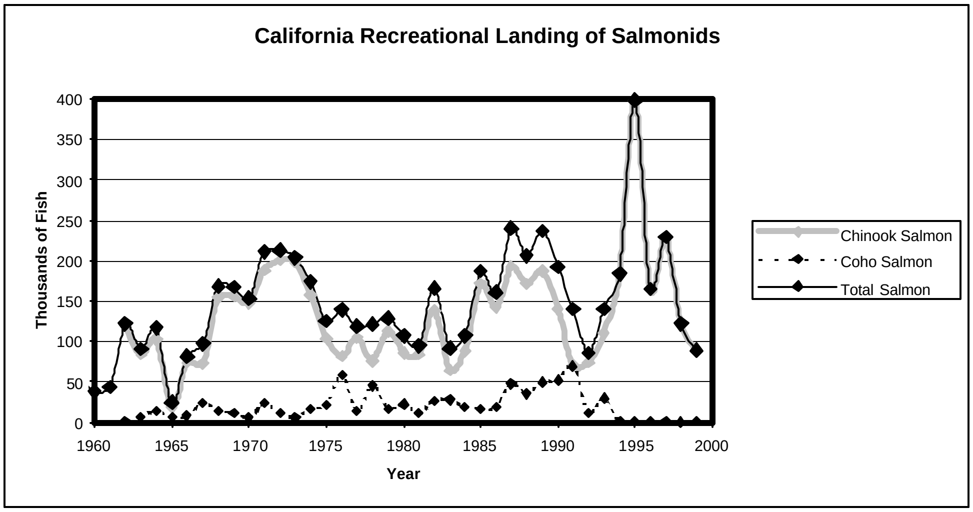


Figure 4. Recreational landings of salmon in California from 1962-1999.

Coho were no longer permitted for take after 1992. Data from CDFG Ocean Salmon Project as reported in California's Living Marine Resources: A Status Report.

Methods

Division of Subbasins

NCWAP determined early on in their efforts that a broad-brush statement about the entire Mattole River Watershed would be difficult to make due to the large amount of variability within the watershed. Therefore, the NCWAP team divided the watershed into five subbasins based on commonalities of attributes.

Investigation of Existing Data

When beginning a watershed assessment, it is important to investigate existing studies and reports in a watershed. Existing data will give direction to a watershed assessment by elucidating data gaps and preventing redundancy in future data collection. In addition, the process of obtaining and using this data will provide an opportunity for participation by interested parties. Lastly, previously collected data will lead to a more comprehensive watershed assessment.

In the Mattole River Assessment, CDFG personnel participated in an extensive literature review to obtain and examine previously collected information. This information was available from both private organizations and public agencies. CDFG formed working relationships with several community-based organizations that have collected information on the Mattole River Watershed. These organizations include the Mattole Restoration Council (MRC), Salmon Restoration Group, and Sanctuary Forest. Literature was photocopied from the organizations' files and brought back to CDFG headquarters to build a library of existing documents. CDFG was also able to obtain information from the Bureau of Land Management (BLM) and the CDFG North Coast Watershed Improvement Center (NCWIC). CDFG coordinated with BLM to gain access to their benthic macroinvertebrate studies and obtained recent stream habitat inventory surveys and electro-fishing inventories from NCWIC. The macroinvertebrate, habitat and electro-fishing data were placed into the library of existing documents. Everything in the library of existing documents was then entered into an annotated bibliography.

All entries in the library of existing documents were scanned for pertinent information and general conclusions about historic salmonid presence and distribution, and habitat conditions were drawn. In addition, macroinvertebrate data obtained from the BLM was further analyzed to provide a general assessment of the biological condition of the stream sites that were surveyed by the BLM.

Stream Surveys

CDFG conducted tributary habitat inventories and biological data collections in the Mattole River Watershed in order to gain a better understanding of existing salmonid habitat and populations. Sixty-one tributaries and the headwaters of the Mattole Basin were surveyed in the watershed from 1991 to 2002 for both physical habitat data and biological data. Stream habitat inventory and biological data surveys were conducted following the protocol presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al. 1998).

Two person crews trained in standardized habitat inventory methods by the CDFG conducted physical habitat inventories during a period from 1991 to 2002. Crews used the Rosgen channel typing method to determine channel types and stratify the streams into reaches. Then, the habitat type and stream length were determined for all habitat units within a survey reach. In addition, approximately 10% of the habitat units within a reach were randomly selected and sampled for all physical parameters (Hopelain, 1994). Physical parameters consisted of nine stream components: flow, channel type, temperature, habitat type, embeddedness, shelter rating, substrate composition, canopy and bank composition, and vegetation (each component is discussed in detail in the Restoration Manual). All habitat types encountered for the first time were also measured for all stream components and all pool habitat types were measured for maximum depths. Streams were surveyed until the end of anadromy was determined. Crews based this judgment on either the presence of physical barriers to fish passage or a steep gradient of 8-10% in a long continuous stretch of the stream for 1000 feet or more.

CDFG fish biologists with Smith Root Model 12 backpack electro-fishing units collected information on salmonid presence and distribution in the tributaries surveyed for habitat inventories. Data were collected from 1991 to 2002. At least one pool, run and riffle combination was sampled in each reach by electro-fishing. Salmonids were identified to species and age class was estimated based on size. Non-salmonid species were also recorded but not classified by age class.

Habitat and biological data for each sampled stream was compiled into a Stream Inventory Report, which is stored at the CDFG office in Fortuna, CA.

Three streams in the Mattole Basin, Oil Creek, Rattlesnake Creek and Green Ridge Creek, were sampled more intensively by CDFG for their salmonid populations from 1991 through 1999. Preliminary data from this study are summarized in the CDFG administrative report *Stream Monitoring Progress Report for Five Small Streams in Northwestern California, Lawrence, Shaw, Oil, Rattlesnake, and Green Ridge Creeks 1991 through 1995* (Hopelain et al. 1997). One of the purposes of this study was to detect any changes in the trends of juvenile salmonid relative abundance. Annual abundance of juvenile salmonids within each sample reach was determined by depletion electro-fishing over several years. Captured fish were identified to species and measured for fork length, and weighed by displacement.

In addition, CDFG identified gaps in the spatial coverage of temperature monitoring devices used by the Mattole Salmon Group (MSG) and the Regional Water Quality Control Board (RWQCG) in 2001. Thereupon, CDFG placed 14 optic stow-away temperature monitors in 12 streams in the Mattole Basin: North Fork Mattole River, Conklin Creek, Boots Creek (a tributary to Conklin Creek), Mill Creek (R.M. 5.5), Squaw Creek, Honeydew Creek, Fourmile Creek, the West Fork of Fourmile Creek, the South Fork of Fourmile Creek, Gilham Creek (2 monitors), Grindstone Creek (two monitors), and Sholes Creek. Monitors were placed in streams between August 15 and September 8, 2001 and retrieved between October 20 and 22, 2001. Data was downloaded and set to Jan Dirkson at the Klamath Resource Information System for analysis.

Limiting Factor Analysis

Introduction

A main objective of the North Coast Watershed Assessment Program (NCWAP) and a task delegated to the Department of Fish and Game (CDFG) is to identify factors that limit production of anadromous salmonid populations in North Coast watersheds. A loosely termed approach to identify these factors is often called a "limiting factors analysis" (LFA). The limiting factors concept is based upon the assumption that eventually every population must be limited by the availability of resources (Hilborn and Walters 1992) or that a population's potential may be constrained by an over abundance, deficiency, or absence of a watershed ecosystem component. Identifying stream habitat factors that limit or constrain anadromous salmonids is an important step towards setting priorities for habitat improvement projects and management strategies aimed the recovery of declining fish stocks and protection of viable fish populations.

Although several factors have contributed to the decline of anadromous salmonid populations, habitat loss and modification are major determinants of their current status (FEMAT 1993). Our approach to a LFA integrates two habitat based methods to evaluate the status of key aspects of stream habitat that affect anadromous salmonid production, species life history diversity, and the stream's ability to support viable populations. The first method uses priority ranking habitat categories based on a CDFG team assessment of data collected during stream habitat inventories. The second method uses a computer-based decision support system, Ecosystem Management Decision Support (EMDS) to evaluate the suitability of key stream habitat components to support anadromous fish populations. These habitat based methods assume that stream habitat quality and quantity play important roles in a watershed's ability to produce viable salmonid populations. The LFA assumes that poor habitat quality and reduced quantities of favorable habitat impairs fish production. The NCWAP LFA is focused mainly on those physical habitat factors within freshwater and estuarine ecosystems that affect spawning and subsequent juvenile life history requirements during low flow seasons.

Two general categories of factors or mechanisms limit salmonid populations: 1) density independent; and 2) density dependent mechanisms. Density independent mechanisms generally operate without regard to population density. These include factors related to habitat quality such as stream flow and water temperature. In general, if water temperatures exceed lethal levels, for example, fish will die regardless of the population density. Density dependent mechanisms generally operate according to population density and habitat carrying capacity. Competition for food, space, and shelter are examples of density dependent factors which affect growth and survival when populations reach or exceed the habitat carrying capacity. The NCWAP's approach considers these two types of habitat factors before prioritizing recommendations for habitat management strategies. Priority steps are given to preserving and increasing the amount of high quality habitat in a cost effective manner.

Methods

The LFA examines a suite of environmental factors that affect anadromous salmonid life cycles beginning with spawning success: egg incubation, fry emergence, juvenile rearing, and movements though the stream network (Table 5). Stream surveys quantify stream habitat factors or characteristics such as pool depth, shade canopy, and spawning substrate embeddedness. Data characterizing stream habitat conditions are collected according to protocols described in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al.1998).

Table 5. Fish habitat components and parameters potentially applicable for limiting factors analysis.

Fish Habitat Components and Parameters	
Water Quality	Flow Temperature Turbidity
Sediments	Pool tail embeddedness Spawning gravel composition, permeability, and stability Bank stability
Riparian Vegetation	Percent Shade canopy by habitat type and average percent by reach, stream, or watershed Species diversity (% coniferous vs deciduous) Seral stage LWD future recruitment Sediment filter Bank stability
Large Wood	Abundance, size, and distribution of in channel large woody debris (LWD) Future recruitment of LWD to stream
Pool and Riffle Habitat Characteristics	Pool depth Residual pool depth and volume Pool, run and riffle frequency Pool, run, and riffle percent of total length of stream Pool shelter complexity Value Coverage (% of habitat coverage) Pool shelter rating (shelter value x % cover)
Barriers or Impediments to Upstream and Downstream Fish Movements	Stream gradient as a barrier to upstream migration Stream crossings Debris jams Excessive sediment deposition attenuating stream flows or creating dry channels Channel connectivity Water temperature
Nutrients	Macroinvertebrate production Macroinvertebrate community diversity Adult salmonid carcasses

Fish sampling is performed to determine species presence and the extent of anadromy in watersheds. Collection of detailed biologic indicators are beyond our current logistic ability and are too complex for analysis considering existing time constraints for report generation, as they may require obtaining many years or even generations of data to make useful conclusions.

Priority rankings of habitat categories are based on a CDFG team assessment of data collected during stream habitat inventories. These inventories are a combination of several stream reach surveys: habitat typing, channel typing, biological assessments, and in some reaches LWD and riparian zone recruitment assessments. An experienced biologist and / or habitat specialist conducts QA/QC on field crews and collected data, performs data analysis, and determines general areas of habitat deficiency based upon the analysis and synthesis of information. Finally, recommendation categories for potential habitat improvement activities are selected and ranked.

Ecosystem Management Decision Support (EMDS) is used to evaluate the suitability of key stream habitat components to support anadromous fish populations. The EMDS analyses compares measures of habitat factors collected at the reach scale during stream surveys to a set of reference conditions determined from empirical studies of naturally functioning channels, expert opinion, and peer reviewed literature. For each factor, the NCWAP team will create a conceptual model that relates parameter values to relative habitat quality or potential suitability for fish. Using these "habitat quality functions" and the EMDS, the various parameters will be combined into an indicator of fish habitat status. The EMDS rates each habitat component with a suitability score between -1 and +1. A score of +1 means high suitability and – 1 means low or inadequate suitability. Scores in between -1 and +1 indicate a degree of suitability between high and low with positive scores associated with suitable conditions and negative scores associated with less suitable conditions. If a habitat component's score does not fit within the suitable range of the reference values, it may be considered a limiting factor. For evaluation at the reach, stream, subbasin, and basin scale, EMDS scores are weighted according to each stream reach length. Scores from long reaches carry more weight than those from short reaches. The equation for calculating stream reach weighted average for identifying stream, subbasin and basin scale limiting factors is:

$$\text{Weighted Average by Stream Reach} = \frac{\sum L_i S_i}{\sum L_i}$$

Where: L_i = reach length
S_i = EMDS score by reach

Habitat components evaluated by the EMDS that receive the lowest overall rating score will be considered as limiting factors. Limiting factors identified by the EMDS will be used to support or refine the broader scoped interpretations derived from CDFG and interdisciplinary watershed synthesis teams assessments. Detailed discussions of analysis using the EMDS and the development of reference curves are provided in Appendix A.

Results from the two LFA methods are displayed in tabular form and then evaluated by CDFG biologists and interdisciplinary watershed synthesis teams. Limiting factors identified by the EMDS will be used to support or refine the broader scoped interpretations derived from CDFG and interdisciplinary watershed synthesis teams assessments. A third list of limiting factors may be generated at the watershed scale for making recommendations for restoration projects or management strategies to improve or maintain stream habitat conditions.

EMDS evaluations from the "watershed condition" knowledge base help identify relationships or associations between watershed processes or land use that contribute to a limiting factor's root cause (see EMDS Appendix). This includes evaluations of road density, riparian condition and upland condition and others. The results generated by the EMDS system are synthesized and integrated with other watershed information collected by the NCWAP team. Finally, the team addresses the factors or issues that may impair fish populations and makes recommendations for improving watershed conditions to benefit salmonid fishery resources.

The CDFG acknowledges that this procedural LFA is a simplified approach to identifying ecosystem components that constrain habitat capacity, fish production, and species life history diversity (Mobrand et al. 1997). Therefore, the LFA is developed for assessing coarse scale stream habitat components and may not satisfy the need for site specific analysis at an individual land owner scale. It is important to understand that LFA tributary survey components and recommendations for habitat improvements are made from stream reach conditions that are observed at the times of the surveys and do not include upslope watershed observations other than those that can be seen from the streambed. In addition, we lack specific habitat surveys for juvenile winter habitat, so we are unable to perform focused winter habitat assessments. Stream surveys reflect a single point in time and do not anticipate future conditions. However, these general recommendation categories have proven to be useful as the basis for specific project development, and provide focus for on-the-ground project design and implementation. Bear in mind that stream and watershed conditions change over time and periodic survey updates and field verification are necessary if projects are being considered.

In general, the recommendations that involve erosion and sediment reduction by treating roads, failing stream banks, and riparian corridor improvements precede the instream recommendations in reaches that demonstrate disturbance levels associated with watersheds in current stress. Instream improvement recommendations are usually a high priority in streams that reflect watersheds in recovery or good health. Projects recommendation can be made in concurrence if conditions warrant.

Fish passage problems, especially in situations where favorable stream reaches are blocked by a man-caused feature (e.g., culvert), are usually a treatment priority. Additional considerations enter into the decision process before general recommendations are further developed into improvement activities. In these regards, NCWAP's more general watershed scale upslope assessments can go a long way in helping determine the suitability of conducting instream improvements based upon watershed health. As such, there is an important relationship between the instream and upslope assessments.

In addition to watershed condition considerations as a context for these recommendations, there are certain logistic considerations that enter into a recommendation's subsequent ranking for project development. These can include work party access limitations based upon lack of private party trespass permission and / or physically difficult or impossible locations of the candidate work sites. Biological considerations are made based upon the propensity for benefit to multiple or single fishery stocks or species. Cost benefit and project feasibility are also factors in project selection for design and development.

NCWAP Salmonid Refugia Identification and Classification

Establishment and maintenance of salmonid refugia areas containing high quality habitat and sustaining fish populations are activities vital to the conservation of our anadromous salmonid resources (Moyle and Yoshiyama 1992; Liet al. 1995; Reeves et al. 1995). Protecting these areas will prevent the loss of the remaining high quality salmon habitat and salmonid populations. Therefore, a refugia investigation project should focus on identifying areas found to have high salmonid productivity and diversity. Identified areas should then be carefully managed for the following benefits:

- Protection of refugia areas to avoid loss of the last best salmon habitat and populations. The focus should be on protection for areas with high productivity and diversity;

- Refugia area populations which may provide a source for re-colonization of salmonids in nearby watersheds that have experienced local extinctions, or are at risk of local extinction due to small populations;
- Refugia areas provide a hedge against the difficulty in restoring extensive, degraded habitat and recovering imperiled populations in a timely manner (Kaufmann, et al. 1997).

The concept of refugia is based on the premise that patches of aquatic habitat provide habitat that still retain the natural capacity and ecologic functions that support wild anadromous salmonids in such vital activities as spawning and rearing. Anadromous salmonids exhibit typical features of patchy populations; they exist in dynamic environments and have developed various dispersal strategies including juvenile movements, adult straying, and relative high fecundity for an animal that exhibits some degree of parental care through nest building (Reeves et al. 1995). Conservation of patchy populations requires conservation of several suitable habitat patches and maintaining passage corridors between them.

Potential refugia may exist in areas where the surrounding landscape is marginally suitable for salmonid production or altered to a point that stocks have shown dramatic population declines in traditional salmonid streams. If altered streams or watersheds recover their historic natural productivity, either through restoration efforts or natural processes, the abundant source populations from nearby refugia can potentially re-colonize these areas or help sustain existing salmonid populations in marginal habitat. Protection of refugia areas is noted as an essential component of conservation efforts to ensure long-term survival of viable stocks, and a critical element towards recovery of depressed populations (Sedell, 1990; Moyle and Yoshiyama 1992; Frissell 1993, 2000).

Refugia habitat elements include the following:

- Areas that provide shelter or protection during times of danger or distress;
- Locations and areas of high quality habitat that support populations limited to fragments of their former geographic range; and
- A center from which dispersion may take place to re-colonize areas after a watershed and / or sub-watershed level disturbance event and readjustment.

Spatial and Temporal Scales of Refugia

These refugia concepts become more complex in the context of the wide range of spatial and temporal habitat required for viable salmonid populations. Habitat can provide refuge at many scales from a single fish to groups of them, and finally to breeding populations. For example, refugia habitat may range from a piece of wood that provides instream shelter for a single fish, or individual pools that provide cool water for several rearing juveniles during hot summer months, to watersheds where conditions support sustaining populations of salmonid species. Refugia also include areas where critical life stage functions such as migrations and spawning occur. Although fragmented areas of suitable habitat are important, their connectivity is necessary to sustain the fisheries. Today, watershed scale refugia are needed to recover and sustain aquatic species (Moyle and Sato 1991). For the purpose of this discussion, refugia are considered at the fish bearing tributary and subbasin scales. These scales of refugia are generally more resilient than the smaller, habitat unit level scale to the deleterious effects of landscape and riverine disturbances such as large floods, persistent droughts, and human activities (Sidell et al. 1990).

Standards for refugia conditions are based on reference curves from the literature and CDFG data collection at the regional scale. NCWAP uses these values in its EMDS models and stream inventory, improvement recommendation process. Li et al. (1995) suggested three prioritized steps to use the refugia concept to conserve salmonid resources.

1. Identify salmonid refugia and ensure they are protected;
2. Identify potential habitats that can be rehabilitated quickly;
3. Determine how to connect dispersal corridors to patches of adequate habitat.

Refugia and Meta-population Concept

The concept of anadromous salmonid meta-populations is important when discussing refugia. The classic metapopulation model proposed by Levins (1969) assumes the environment is divided into discrete patches of suitable habitat. These patches include streams or stream reaches that are inhabited by different breeding populations or sub-populations (Barnhart 1994,; McElhany et al. 2000). A metapopulation consists of a group of sub-populations which are geographically located such that over time, there is likely genetic exchange between the sub-populations (Barnhart 1994). Metapopulations are characterized by 1) relatively isolated, segregated breeding populations in a patchy environment that are connected to some degree by migration between them, and 2) a dynamic relationship between extinction and re-colonization of habitat patches.

Anadromous salmonids fit nicely into the sub-population and metapopulation concept because they exhibit a strong homing behavior to natal streams forming sub-populations, and also have a tendency to stray into new areas. The straying or movement into nearby areas results in genetic exchange between sub-populations or seeding of other areas where populations are at low levels. This seeding comes from abundant or source populations supported by high quality habitat patches which may be considered as refugia.

Habitat patches differ in suitability and population strength. In addition to the classic metapopulation model, other theoretical types of spatially structured populations have been proposed (Li et al. 1995; McElhany et al. 2000). For example, the core and satellite (Li et al. 1995) or island-mainland population (McElhany et al. 2000) model depicts a core or mainland population from which dispersal to satellites or islands results in smaller surrounding populations. Most straying occurs from the core or mainland to the satellites or islands. Satellite or island populations are more prone to extinction than the core or mainland populations (Li et al. 1995; McElhany et al. 2000). Another model termed source-sink populations is similar to the core-satellite or mainland-island models, but straying is one way, only from the highly productive source towards the sink subpopulations. Sink populations are not self-sustaining and are highly dependant on migrants from the source population to survive (McElhany et al. 2000). Sink populations may inhabit typically marginal or unsuitable habitat, but when environmental conditions strongly favor salmonid production, sink population areas and may serve as important sites to buffer populations from disturbance events (Li et al. 1995) and increase basin population strength. In addition to testing new areas for potential suitable habitat, the source-sink strategy adds to the diversity of behavior patterns salmonids have adapted to maintain or expand into a dynamic aquatic environment.

The metapopulation and other spatially structured population models are important to consider when identifying refugia because in dynamic habitats, the location of suitable habitat changes (McElhany et al. 2000) over the long term from natural disturbance regimes (Reeves et al. 1995) and over the short term by human activities. Satellite, island, and sink populations need to be considered in the refugia selection process because they are an integral component of the metapopulation concept. They also may become the source population or refugia areas of the future.

Methods to Identify Refugia

Currently there is no established methodology to designate refugia habitat for California's anadromous salmonids. This is mainly due to a lack of sufficient data describing fish populations, meta-populations and habitat conditions and productivity across large areas. This lack of information holds true for NCWAP basins especially in terms of meta-population dynamics. Studies are needed to determine population growth rates and straying rates of salmonid populations and sub-populations to better utilize spatial population structure to identify refugia habitat.

Classification systems, sets of criteria and rating systems have been proposed to help identify refugia type habitat in north coast streams, particularly in Oregon and Washington (Moyle and Yoshiyama 1992; FEMAT 1993; Li et al. 1995; Frissell et al. 2000; Kisup County, 2000). Upon review of these works, several common themes emerge. A main theme is that refugia are not limited to areas of pristine habitat. While ecologically intact areas serve as dispersal centers for stock maintenance and potential recovery of depressed sub-populations, lower quality habitat areas also play important roles in long term salmonid metapopulation maintenance. These areas may be considered the islands, satellites, or sinks in the metapopulation concept. With implementation of ecosystem management strategies aimed at maintaining or restoring natural processes, some of these areas may improve in habitat quality, show an increase in fish numbers and add to the metapopulation strength.

A second common theme is that over time within the landscape mosaic of habitat patches, good habitat areas will suffer impacts and become less productive, and wink out and other areas will recover and wink in. These processes can occur through either human caused or natural disturbances or succession to new ecological states. Regardless, it is important that a balance be maintained in this alternating, patchwork dynamic to ensure that adequate good quality habitat is available for viable anadromous salmonid populations (Reeves et al. 1995.)

NCWAP Approach to Identifying Refugia

The NCWAP interdisciplinary team identified and characterized refugia habitat by using expert professional judgment and criteria developed for north coast watersheds. The criteria considered different values of watershed and stream ecosystem processes, the presence and status of fishery resources, forestry and other land uses, land ownership, potential risk from sediment delivery, water quality, and other factors that may affect refugia productivity. The expert refugia team encourages other specialists with local knowledge to participate in the refugia identification and categorization process.

The team also used results from information processed by NCWAP's EMDS at the stream reach and planning watershed / subbasin scales. Stream reach and watershed parameter evaluation scores were used to rank stream and watershed conditions based on collected field data and air photo analysis. Stream reach scale parameters included pool shelter rating, pool depth, embeddedness, and canopy cover. Water temperature data was also used when available. The individual parameter scores identified which habitat factors currently support or limit fish production (see EMDS and limiting factors sections).

Planning watershed scale parameters used were road density, number of stream crossings, road proximity to streams, riparian cover, and LWD loading potential. The refugia team used the potential sediment production and other planning watershed scale EMDS evaluations in a similar manner as they become available.

When identifying anadromous salmonid refugia the NCWAP team took into account that anadromous salmon have several non-substitutable habitat needs for their life-cycle. A minimal list (NMFS 2000) includes:

- Adult migration pathways;
- Spawning and incubation habitat;
- Stream rearing habitat;
- Forage and migration pathways;
- Estuarine habitat.

The best refugia areas are large and meet all of these life history needs and therefore provide complete functionality to salmonid populations. These large, intact systems are scarce today and smaller refugia areas that provide for only some of the requirements have become very important areas, but cannot sustain large numbers of fish. These must operate in concert with other fragmented habitat areas for life history support and connectivity becomes very important for success. Therefore, the refugia team considered relatively small, tributary areas in terms of their ability to provide at least partial refuge values, yet contribute to the aggregated refugia of larger scale areas. Therefore, the team's analyses used the tributary scale as the fundamental refugia unit.

The NCWAP team created a tributary scale refugia rating worksheet (CDFG Appendix). The worksheet has 21 condition factors that were rated on a sliding scale from high quality to low quality. The 21 factors were grouped into five categories: 1) stream condition; 2) riparian condition; 3) native salmonid status; 4) present salmonid abundance; 5) management impacts (disturbance impacts to terrain, vegetation, and the biologic community). The tributary ratings were determined by combining the results of air photo analyses results, EMDS results, and data in the CDFG tributary reports by a multi-disciplinary, expert team of analysts. The various factors' ratings were combined to determine an overall tributary rating on a scale from high to low quality refugia. The tributary ratings were subsequently aggregated at the subbasin scale and expressed a general estimate of the subbasin refugia conditions. Factors with limited or missing data were noted. In most cases there were data limitations on 1 – 3 factors. These were identified for further investigation and inclusion in future analysis.

The NCWAP has created a hierarchy of refugia categories that contain several general habitat conditions. This descriptive system is used to rank areas by applying the results of the analyses of stream and watershed conditions described above and are used to determine the ecological integrity of the study area. A basic definition of biotic integrity is "the ability [of an ecosystem] to support and maintain a balanced, integrated, and functional organization comparable to that of the natural habitat of the region" (Karr and Dudley 1981).

The Report of the Panel on the Ecological Integrity of Canada's National Parks submitted this definition:

> A Definition of Ecological Integrity
>
> The Panel proposes the following definition of ecological integrity: "An ecosystem has integrity when it is deemed characteristic for its natural region, including the composition and abundance of native species and biological communities, rates of change and supporting processes." In plain language, ecosystems have integrity when they have their native components (plants, animals and other organisms) and processes (such as growth and reproduction) intact.

NCWAP Salmonid Refugia Categories and Criteria:

High Quality Refugia

- Maintains a high level of watershed ecological integrity (Frissell 2000);
- Contains the range and variability of environmental conditions necessary to maintain community and species diversity and supports natural salmonid production (Moyle and Yoshiyama 1992; Frissell 2000);
- Relatively undisturbed and intact riparian corridor;
- All age classes of historically native salmonids present in good numbers, and a viable population of an ESA listed salmonid species is supported (Li et al. 1995);
- Provides population "seed sources" for dispersion, gene flow and re-colonization of nearby habitats from straying local salmonids;
- Contains a high degree of protection from degradation of its native components.

High Potential Refugia

- Watershed ecological integrity is diminished but remains good (Frissell 2000);
- Instream habitat quality remains suitable for salmonid production and is in the early stages of recovery from past disturbance;
- Riparian corridor is disturbed, but remains in fair to good condition;
- All age classes of historically native salmonids are present including ESA listed species, although in diminished numbers;
- Salmonid populations are reduced from historic levels, but still are likely to provide straying individuals to neighboring streams;
- Currently is managed to protect natural resources and has resilience to degradation, which demonstrates a strong potential to become high quality refugia (Moyle and Yoshiyama 1992; Frissell 2000).

Medium Potential Refugia

- Watershed ecological integrity is degraded or fragmented (Frissell, 2000);
- Components of instream habitat are degraded, but support some salmonid production;
- Riparian corridor components are somewhat disturbed and in degraded condition;
- Native anadromous salmonids are present, but in low densities; some life

stages or year classes are missing or only occasionally represented;
- Relative low numbers of salmonids make significant straying unlikely;
- Current management or recent natural events have caused impacts, but if positive change in either or both occurs, responsive habitat improvements should occur.

Low Quality Habitat, Low Potential Refugia
- Watershed ecological integrity is impaired (Frissell, 2000);
- Most components of instream habitat are highly impaired;
- Riparian corridor components are degraded;
- Salmonids are poorly represented at all life stages and year classes, but especially in older year classes;
- Low numbers of salmonids make significant straying very unlikely;
- Current management and / or natural events have significantly altered the naturally functioning ecosystem and major changes in either of both are needed to improve conditions.

Other Related Refugia Component Categories:
Potential Future Refugia (Non-Anadromous)
- Areas where habitat quality remains high but does not currently support anadromous salmonid populations;
- An area of high habitat quality, but anadromous fish passage is blocked by man made obstructions such as dams or poorly designed culverts at stream crossings etc.

Critical Contributing Areas
- Area contributes a critical ecological function needed by salmonids such as providing a migration corridor, conveying spawning gravels, or supplying high quality water (Li et al. 1995)
- Riparian areas, floodplains, and wetlands that are directly linked to streams (Huntington and Frissell 1997).

Data Limited
- Areas with insufficient data describing fish populations, habitat condition watershed conditions, or management practices.

Refugia Worksheet and Summary Tables
This worksheet provides a list of key factors upon which NCWAP refugia categories are based (Table 6). “Ecologic Integrity” is used to summarize the evaluations of these criteria. Evaluations of these factors at the tributary scale are used to determine refugia classification for each stream, and then combined for a general subbasin refugia rating.

Table 6. NCWAP refugia worksheet.

Stream Name:			**Date:**
Raters:			
Ecological Integrity - Overall Refugia Summary Ratings:	High Quality; High Potential; Medium Potential; Low Quality (Other: *Non-Anadromous; Contributing Functions; Data Limited*)		
Stream Condition:	**High Quality**	**Medium Quality**	**Low Quality**
Stream Flow			
Water Temperature			
Free Passage			
Gravel			
Pools			
Shelter			
In-Channel Large Wood			
Canopy			
Nutrients			
Stream Summary Rating:			
Riparian Condition:	**High Quality**	**Medium Quality**	**Low Quality**
Forest Corridor Seral Stage			
Fluvial Disequilibrium			
Aquatic/Riparian Community			
Riparian Summary Rating:			
Native Salmonids Status: (Native Species and Age Classes)	**Present**	**Diminished**	**Absent**
Chinook			
Coho			
Steelhead			
Species Summary Rating:			
Salmonid Abundance:	**High**	**Medium**	**Low**
Chinook			
Coho			
Steelhead			
Abundance Summary Rating:			
Management Impacts:	**Low Impacts**	**Medium Impacts**	**High Impacts**
Disturbed Terrain			
Displaced Vegetation			
Native Biologic Integrity			
Impacts Summary Rating:			
Comments:			

The NCWAP team created the tributary scale refugia rating worksheet (Table 6). The worksheet has 21 condition factors that were rated on a sliding scale from high quality to low quality. The 21 factors were grouped into five categories: 1) stream condition; 2) riparian condition; 3) native salmonid status; 4) present salmonid abundance; 5) management impacts (disturbance impacts to terrain, vegetation, and the biologic community). The tributary ratings were determined by combining the results of air photo analyses results, EMDS results, and data in the CDFG tributary reports by a multi-disciplinary, expert team of analysts. The various factors' ratings were combined to determine an overall tributary rating on a scale from high to low quality refugia. The tributary ratings were subsequently aggregated at the subbasin scale and expressed a general estimate of the subbasin refugia conditions. Factors with limited or missing data were noted. In most cases there were data limitations on 1 – 3 factors. These were identified for further investigation and inclusion in future analysis.

The rating sheet is used by placing an "X" on a sliding scale extending from High Quality to Low Quality in each row of the rating sheet. Please consult the NCWAP refugia criteria discussion for guidance. The sheet should be filled out by qualified and knowledgeable analysts from the various watershed specialties, and in consultation with interested constituents familiar with subject areas. The comments section can be used to explain items like missing data, or special situations like diversions or dams, etc.

After the sheets are completed, average the ratings in each section, and then average the five sections' mean ratings to produce an overall summary rating for the sub-watershed (stream) (Table 7). These stream ratings can then be normalized by stream distance and / or sub-watershed area and once more combined to produce a subbasin level mean refugia rating useful for comparison between subbasins (

Table 8).

Although the range of variance within these layers is somewhat blurred through this "lumping" procedure, particulars and detail can be regained by focusing back down through the layers from subbasin to sub-watershed, stream, and finally to the individual parameters. In this manner guidance can be given to an analyst investigating opportunities for watershed improvements through restoration or management activities.

Table 7. Tributary refugia categories rating summary table (Mattole Basin).

		Refugia Categories:				Other Categories:		
Subbasin	**Stream**	**High Quality**	**High Potential**	**Medium Potential**	**Low Quality**	**Non-Anadromous**	**Critical Contributing Area/Function**	**Data Limited**
Northern Subbasin	North Fork Mattole River			X			X	X
	Sulphur Creek			X				X
	Sulphur Creek Tributary #1			X				X
	Sulphur Creek Tributary #2			X				X
	Conklin Creek			X				X
	McGinnis Creek			X				X
	Oil Creek			X				X
	Green Ridge Creek				X			X
	Devils Creek			X				X
	Rattlesnake Creek			X				
Eastern Subbasin	Dry Creek				X			
	Middle Creek				X			
	Westlund Creek			X				X
	Gilham Creek		X					X
	Gilham Creek Tributary			X				X
	Fourmile Creek				X			X
	North Fork Fourmile Creek				X			X
	Sholes Creek			X				X
	Harrow Creek		X					X
	Grindstone Creek			X				X
	Little Grindstone Creek			X				X
	Blue Slide Creek			X				X
	Fire Creek			X				X
	Box Canyon Creek			X				X
	Eubank Creek		X					X
	McKee Creek		X					X
	McKee Creek Tributary			X				X
	Painter Creek		X					X
Southern Subbasin	Mattole River Tributary		X					X
	Bridge Creek		X					X
	West Fork Bridge Creek		X					X
	South Branch West Fork Bridge Creek		X					X
	Vanauken Creek		X					X
	South Fork			X				X

Subbasin	Stream	Refugia Categories:				Other Categories:		
		High Quality	**High Potential**	**Medium Potential**	**Low Quality**	**Non-Anadromous**	**Critical Contributing Area/Function**	**Data Limited**
	Vanauken Creek							
	Anderson Creek		X					X
	Mill Creek (RM 56.2)		X					X
	Upper Mattole River			X				X
	Stanley Creek		X					X
	Baker Creek		X					X
	Thompson Creek		X					X
	Yew Creek			X				X
	Helen Barnum Creek		X					X
	Lost Man Creek		X					X
	Lost Man Creek Tributary		X					X
Western Subbasin	Mill Creek (RM 2.8)		X					X
	Mill Creek (RM 2.8) Tributary #1			X				X
	Mill Creek (RM 2.8) Tributary #2			X				X
	Squaw Creek			X				X
	Woods Creek			X				X
	Honeydew Creek			X				X
	Bear Trap Creek			X				X
	East Fork Honeydew Creek			X				X
	Upper East Fork Honeydew Creek			X				X
	West Fork Honeydew Creek			X				X
	Bear Creek	X						X
	Jewett Creek			X				X
	North Fork Bear Creek		X					X
	North Fork Bear Creek Tributary		X					X
	South Fork Bear Creek		X					
	Big Finley Creek		X					X
	South Fork of Big Finley Creek		X					X
	Nooning Creek			X				X

Table 8. Subbasin refugia summary table (Mattole Basin).

Subbasin	Refugia Categories:				Other Categories:		
	High Quality	**High Potential**	**Medium Potential**	**Low Quality**	**Non-Anadromous**	**Critical Contributing Area/Function**	**Data Limited**
Estuary Subbasin			X			X	X
Northern Subbasin			X				X
Eastern Subbasin			X				X
Southern Subbasin		X					X
Western Subbasin			X				X

Review of Existing Data

Though anecdotal evidence provides a convincing case that anadromous salmonid runs in the Mattole Basin were large and have experienced a sharp decline since the mid 1950s, little quantitative historic data exists (BLM, 1996). Estimates of Chinook salmon, coho salmon, and steelhead trout populations in the Mattole Basin were made by the United States Fish and Wildlife Service (USFWS) in 1960. Existing population estimates were based on spawning gravel surveys and interviews with sportsmen and local residents. Potential population estimates were based on spawning gravel surveys. Existing populations of 2,000 Chinook salmon, 5,000 coho salmon and 12,000 steelhead trout were estimated, while potential populations of 7,900 pairs of Chinook salmon, 10,000 pairs of coho salmon and 10,000 pairs of steelhead trout were predicted (Figure 5).

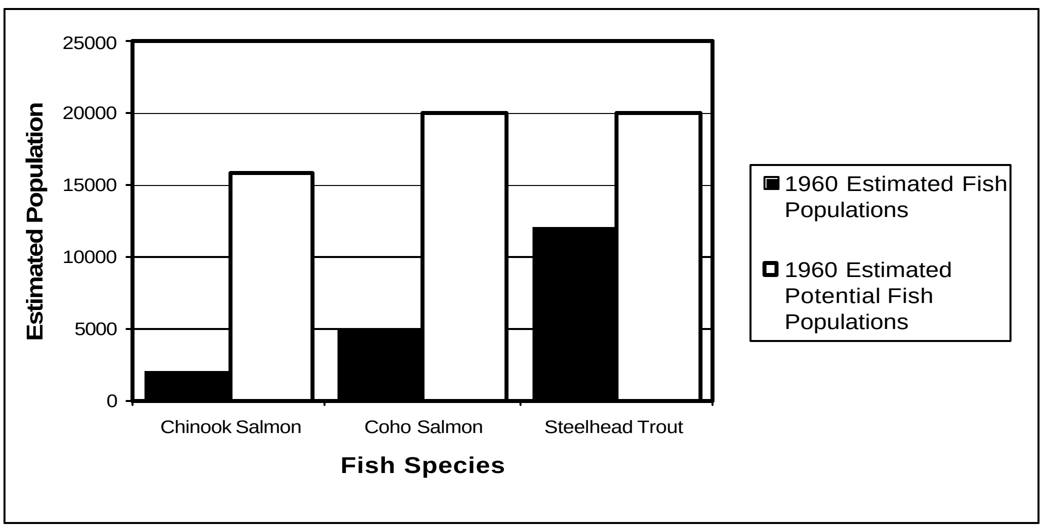


Figure 5. 1960 USFWS estimates of fish populations and potential fish populations in the Mattole Basin.

In 1965, the Department of Water Resources (DWR) reported that Chinook salmon were able to access the Mattole River for 45 miles, while coho salmon and steelhead trout used several more miles of the river. Chinook salmon spawned mostly on the mainstem according to DWR, though several tributaries such as the North Fork of the Mattole River, Squaw Creek, Honeydew Creek, and Bear Creek also provided suitable spawning areas. Coho salmon and steelhead trout were thought to spawn mostly in smaller tributaries throughout the basin. However, ongoing spawner surveys conducted by CDFG and MSG since 1981 have documented Chinook salmon, as well as coho salmon and steelhead trout, spawning clear to the Mattole River's headwaters (river mile (RM) 70).

DWR (1965) also speculated that increases in siltation and debris jams following intensive logging that started in 1952 had caused a significant reduction in the size of anadromous fish runs since 1955. Prior to 1954, the Mattole River had an exceptionally good winter steelhead trout fishery. The fishery had deteriorated seriously since then. In fact, DWR stated that:

> It is sufficient to note here that the Mattole River was formerly one of the better king salmon (Chinook salmon), steelhead (trout), and silver salmon (coho salmon) producers of the entire coast. Since 1950, excessive logging operations have taken place in the drainage, which has severely damaged the stream, primarily from siltation. The stream is still considered to have the potential to again be the major fish producer that it was historically if improved logging and land management principles are followed.

Most of the Chinook salmon catch after 1954 was made during November, although an occasional fish was taken in the estuary as early as October. Steelhead trout and an occasional coho salmon were taken whenever water conditions were favorable. USFWS surveys during 1956-1957 and 1957-1958 seasons indicated that an average of 4300 angler days were spent on the river, resulting in a catch of 400 salmon, 700 steelhead trout, and about 8000 juvenile steelhead trout. A need for better stream survey data was recognized in 1965, when CDFG recommended that thorough surveys of existing conditions be carried out so as "to permit management of the resource by knowledge, not guesswork."

CDFG conducted 65 stream surveys on 58 Mattole River tributaries in the mid 1960s. Survey reports included drainage, stream condition, habitat suitability, stream obstruction, and fisheries descriptions. Salmonid presence and habitat characteristics were usually determined by direct observation. Survey reports concluded with recommendations for management. CDFG continued to survey streams in the Mattole Basin in the 1970s and 1980s with an emphasis on locating possible salmonid passage barriers. . Coho salmon and steelhead trout presence was documented in tributaries throughout the Mattole Basin (

Table 9). With the publication of the first edition of the *California Salmonid Stream Habitat Restoration Manual* in 1991, stream survey methodologies used by CDFG became standardized and more quantitative. Sixty-two tributary reports were completed for the Mattole Basin from 1991-2002. Biological inventories were conducted on 33 of the surveyed tributaries; coho salmon were detected in eight surveyed tributaries and steelhead trout were detected in all 33 surveyed tributaries. More details about CDFG stream surveys and inventories are in the review of available data by subbasin and condensed tributary reports sections of this Appendix.

Table 9. Coho Salmon and Steelhead Trout Presence Detected in CDFG Stream Surveys and Stream Inventories.

Subbasin	1950-1989 CDFG Stream Surveys			1990s CDFG Basin Planning Project		
	Number of Streams Surveyed	Number of Streams Where Coho Salmon Were Detected*	Number of Streams Where Steelhead Trout Were Detected*	Number of Streams Surveyed	Number of Streams Where Coho Salmon Were Detected	Number of Number of Streams Where Steelhead Trout Were Detected
Estuary Subbasin	NA	NA	NA	NA	NA	NA
Northern Subbasin	14	2	13	3	0	3
Eastern Subbasin	14	2	6	10	1	10
Southern Subbasin	8	1	8	10	5	10
Western Subbasin	25	5	15	10	2	10

*These numbers do not include unidentified salmonid observations.

The BLM also conducted 40 stream surveys in the Mattole Basin starting in the 1970s. BLM survey reports included access, drainage, stream conditions, habitat suitability, and fisheries descriptions. Salmonid presence and habitat characteristics were usually determined by direct observation. Survey reports concluded with recommendations for management. BLM surveys documented the presence of steelhead trout in tributaries throughout the Mattole Basin, but only document coho salmon in one tributary (Table 10). More details about BLM stream surveys are in the review of available data by subbasin section of this Appendix.

Table 10. Coho Salmon and Steelhead Trout Presence Detected in BLM Stream Surveys.

Subbasin	Number of Streams Surveyed	Number of Streams where Coho Salmon Were Detected*	Number of Streams where Steelhead Trout Were Detected*
Estuary Subbasin	NA	NA	NA
Northern Subbasin	1	0	1
Eastern Subbasin	3	0	2
Southern Subbasin	3	0	1
Western Subbasin	18	1	6

*These numbers do not include unidentified salmonid observations.

C.J. Brown (1972, 1973a, 1973b) conducted a study of the downstream migrations of salmonids, a creel census and fisherman-use count, and an estimate of salmonid standing stocks for the Mattole River. Downstream outmigrant salmonids were trapped in the spring of 1972 to gain some insight into their distribution within the Mattole River and the timing of their outmigration (Brown 1972). Nets were set on the Mattole River 1.5 miles above the Petrolia Bridge, and 100 yards below the mouth of Bear Creek in between April and June. Results indicated that juvenile Chinook salmon outmigration in the Mattole River ceased by May, coho salmon outmigrants were present from April through June, and steelhead trout exhibited some downstream movement in May and June. Brown (1972) also speculated that the Mattole estuary may be an important rearing area for Chinook salmon and steelhead trout.

A census of angler use and catch was made in February 1972 and from September 1972 through February 1973 on the Mattole River downstream from Honeydew to determine the general nature of the fisheries and the number of fishable days occurring during a typical year (Brown 1973a). Two distinct groups of anglers were found to fish in the Mattole River: salmon anglers and steelhead anglers. Salmon anglers were characterized as local residents who fished from boats in the estuary from late September until winter storms allowed salmon to move upstream in early November. Fourteen anglers sampled in October 1972 had a catch per angler hour of 0.124.

Steelhead anglers were characterized as excellent fishermen who traveled long distances, put in long days fishing, and were frequently successful. An average angler-day was 7.1 hours, the average catch per angler day was 0.45, and the average catch per angler hour was 0.064 in February 1972.

The Mattole River was fishable for only 9 ½ days during February of 1972, though every day from May through August 1972 was fishable. Most of September and October were fishable, but turbid water limited fishing to only a few days per month by November 1972. Turbidity prevailed throughout most of the steelhead fishing season (November 21, 1972 through February 28, 1973), though at least 28 days were fishable. The river had been fishable for 24 days during the 1971-72 steelhead fishing season.

Estimates of the abundance and distribution of juvenile salmonids in the Mattole Basin were made in 1972 to determine the effect of a proposed dam on salmonid resources (Brown 1973b). The proposed dam was to be built at Nooning Creek (RM 50.2). Standing stocks of salmonids were estimated at 24 stations (18 stations above the proposed dam and six below the proposed dam) in the Mattole Basin using electrofishing surveys (

Table 11). Salmonid populations on the mainstem Mattole River averaged 136 salmonids per 100 feet near Ettersburg and 61 salmonids per 100 feet in the headwaters above Bridge Creek (RM 52.1). Young-of-the-year steelhead trout predominated at these stations. Coho salmon fry were found at only one station on the mainstem Mattole River, at RM 58.6 in the Southern Subbasin

Table 11. Estimates of salmonid populations in 1973 at 100 foot sampling stations on the Mattole River and tributaries (after Brown 1973b).

Subbasin	Location	100 foot section population estimate (95% confidence interval)	% Species composition		
			Steelhead trout		Juvenile Coho salmon
			Young-of-the-year	Yearling & older	
Mainstem	Mattole River under Ettersburg Bridge	67 (58-76)	93	7	0
	Mattole River 0.5 miles above Bear Creek	201 (125-277)	100	0	0
Northern	North Fork of the Mattole River (0.5 miles downstream from Petrolia Road Bridge)	122 (102-142)	87	13	0
	North Fork of the Mattole River (1.5 miles above the mouth)	250 (208-292)	95	5	0
Eastern	Mattole Canyon Creek (near mouth)	608 (406-810)	98	1	1
	McKee Creek (near mouth)	209 (201-217)	99	1	0
	McKee Creek (1.0 mile above mouth)	67 (59-75)	60	40	0
Southern	Mattole River 100 yards downstream from Bridge Creek	151 (138-164)	*	*	0
	Mattole River 10 yards upstream from Baker Creek	45 (43-47)	98	2	0
	Mattole River 0.5 miles upstream from Baker Creek	98 (79-117)	84	16	0
	Mattole River 1.0 miles upstream from Baker Creek	33 (31-35)	81	13	6
	Mattole River 0.5 miles upstream from Thompson Creek	127 (113-141)	92	8	0
	Mattole River 1.5 miles upstream from Thompson Creek	30 (21-39)	85	15	0
	Mattole River 2.0 miles upstream from Thompson Creek	35 (31-39)	82	18	0
	Vanauken Creek (near mouth)	112 (99-125)	99	1	0
	Vanauken Creek (1.0 mile above mouth)	37 (34-40)	100	0	0
	Mill Creek (R.M. 56.2, near mouth)	14 (10-18)	100	0	0
	Mill Creek (R.M. 56.2, 1.0 mile above mouth)	62 (55-69)	100	0	0
	Harris Creek (near mouth)	48 (40-56)	98	0	2
	Baker Creek (near mouth)	58 (48 – 68)	79	0	21
	Baker Creek (1.0 mile above mouth)	50 (47-53)	80	3	17
	Thompson Creek (near mouth)	71 (61-81)	95	5	0
	Thompson Creek (1.0 mile above mouth)	62 (50-74)	81	2	17
Western	Squaw Creek (near mouth)	74 (57-91)	100	0	0

* Juvenile steelhead not separated by age at this station.

Average salmonid populations at 15 stations on tributaries to the Mattole River ranged from 39 to 596 salmonids per 100 feet. Young-of-the-year steelhead trout predominated at all tributary stations. Coho salmon were found at four stations on tributaries (Harris Creek, Baker Creek, Thompson Creek, and Mattole Canyon Creek). Sampling effort was not sufficient to accurately estimate the numbers of salmonids in the mainstem Mattole River above the proposed Nooning Creek dam site. Nevertheless, Brown (1973b) very roughly estimated that the proposed dam would eliminate nursery areas for 125,283 juvenile steelhead trout and 1,713 juvenile coho salmon.

The Coastal Headwaters Association surveyed just over 200 perennial stream miles in the Mattole Basin in the early 1980s under contract with CDFG. They conducted five different types of stream surveys: pre-inventory surveys, ocular surveys, detailed habitat surveys, spot-checks, and high-water surveys.

Pre-inventory surveys consisted of obtaining land-owner permission to access streams, and obtaining and reviewing all available maps for an area, previous stream surveys, and historical information. Ocular surveys provided a basic description of fish populations, habitat conditions, and rehabilitation needs but usually did not involve the collection of quantitative data. Detailed habitat surveys were similar to ocular surveys, but included actual measurements of habitat features such as pools, runs, and riffles. Spot-checks consisted of fish and habitat observations at point locations in easily accessible areas like bridges. Spot-checks often included the use of minnow-traps to sample juvenile salmonids. Lastly, high-water surveys were used to estimate spawning salmonid populations and followed procedures used by the CDFG Anadromous Fisheries Branch (1981).

Findings of the Coastal Headwaters Association's stream surveys were summarized in the First Annual Report of the Mattole Survey Program in 1982. Coastal Headwaters Association stream surveys document the presence of steelhead trout throughout the Mattole Basin, and coho salmon in every subbasin except the Northern Subbasin (Table 12). More details about Coastal Headwaters Association stream surveys are in the review of available data by subbasin section of this Appendix.

Table 12. Coho Salmon and Steelhead Trout Presence Detected in Coastal Headwaters Association Stream Surveys.

Subbasin	Number of Streams Surveyed	Number of Streams where Coho Salmon Were Detected*	Number of Streams where Steelhead Trout Were Detected*
Estuary Subbasin	NA	NA	NA
Northern Subbasin	6	0	5
Eastern Subbasin	8	3	6
Southern Subbasin	9	4	7
Western Subbasin	15	5	9

*These numbers do not include unidentified salmonid observations.

Additional sources of information about anadromous salmonids in the Mattole Basin include watershed analyses, other studies of tributaries and salmonids, and stocking records. Detailed Watershed Analyses have been carried out by the BLM for Bear Creek (1995), Honeydew Creek (1996), and Mill Creek (lower) (2001), and Hamilton (1982) surveyed Nooning Creek as part of a research proposal. Additionally, Nehlsen et al. (1991) and Higgins et al. (1992) both mention Mattole salmonid runs in their overviews of the risk of extinction of salmon runs in the Pacific and Northern California, respectively. They postulated that fall-run Chinook salmon and coho salmon in the Mattole Basin had a high risk of extinction. More details are in the review of available data by subbasin section of this Appendix.

The Mattole Basin was stocked by CDFG with steelhead trout, coho salmon and/or Chinook salmon from 1930 to 1981 (Table 13). The vast majority of fish released were steelhead.

Table 13. Stocking records for the Mattole Basin from 1930 to 1981.

Date	Species	Number	Where Released
1930	Steelhead	50,000	
1931	Steelhead	50,000	Upper Mattole River
1932	Steelhead	105,000	
1933	Steelhead	40,000	Upper Mattole River
1933	Steelhead	30,000	At Thorn and Ettersburg
1934	Steelhead	20,000	At Thorn and Ettersburg
1934	Steelhead	10,000	North Fork Mattole River
1934	Steelhead	10,000	
1935	Steelhead	60,000	Upper Mattole River
1935	Steelhead	36,000	North Fork Mattole River
1935	Steelhead	36,000	
1936	Steelhead	25,000	Upper Mattole River
1936	Steelhead	20,000	North Fork Mattole River
1936	Steelhead	20,000	
8/22 – 23/1938	Steelhead	2,690	Upper Mattole River
8/23/1938	Coho salmon	1,000	
8/22-24/1938	Chinook salmon	4,940	Upper Mattole River
6/20/1961	Steelhead	~59,000	Ettersburg
6/21/1961	Steelhead	~42,000	Ettersburg
6/21/1961	Steelhead	~86,000	Honeydew
5/9/1972	Steelhead	10,220	Bear Creek
5/10/1972	Steelhead	9,520	2 miles north of Whitethorn
5/12/1972	Steelhead	10,325	2 miles north of Shelter Cove
4/25/1973	Steelhead	19,067	2 miles north of Whitethorn
5/19/1975	Steelhead	30,012	2 miles north of Whitethorn
3/3-5/1981	Steelhead	100,000	Above or below Honeydew

The Mattole Salmon Group (MSG) was formed in 1980 as a response to local citizen's concerns about declining salmonid populations. MSG represents a watershed-wide, entirely citizen-run effort to begin restoring native salmon runs. MSG promotes and operates a broad-based program aimed at restoring the native salmonid fishery in the Mattole Basin. Two important focus areas of the MSG program are monitoring fish populations, and maintaining and enhancing the remnant runs of native fall-run Chinook salmon and coho salmon (MSG 2000).

MSG monitors fish population in the Mattole Basin through spawning surveys and downstream migrant trapping. As a part of their activities, MSG has conducted annual spawning surveys since the 1981-1982 season to provide estimates of salmon escapement in specific index reaches and for extrapolation to basin-wide population levels. Estimated basin-wide populations of Chinook salmon and coho salmon for the 1999-2000 season were 700 and 300, respectively (Figure 6). The coho salmon population has been estimated to be less than 1,000 since 1981 and below 100 from 1989 to 1992. Chinook salmon populations, although higher, also ranged to critically low levels- with only an estimated 100 to 400 adults in the years 1989-1993.

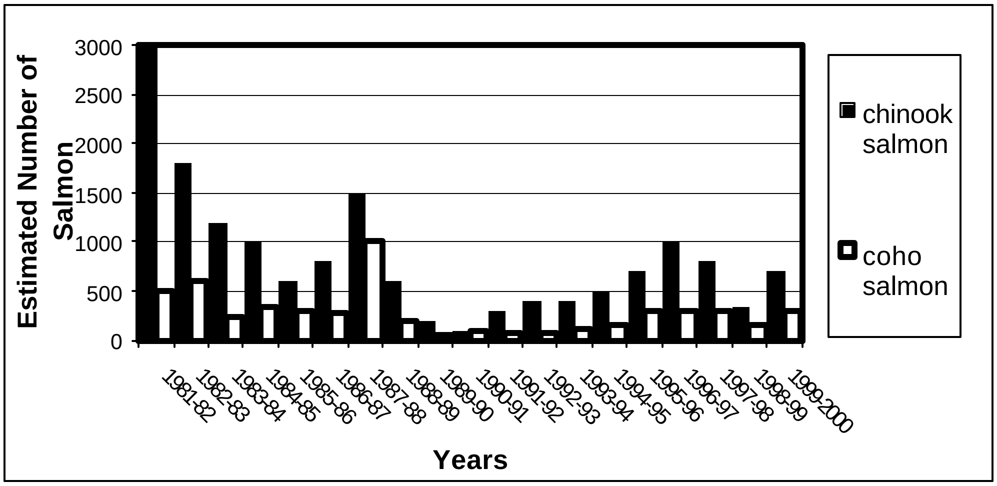


Figure 6. Mattole Salmon Group estimates of returning adult Chinook and coho salmon spawners to the Mattole Basin from 1981-2000.

Data is based on annual synthesis of spawning surveys and counts at a temporary fish weir in the Mattole River near the confluence with Mill Creek (R.M. 3.0). Data provided by the Mattole Salmon Group.

Small populations of organisms are at a greater risk of extinction from genetic problems, demographic fluctuations, and environmental fluctuations. A loss of genetic variability can be caused by inbreeding, loss of heterozygosity, and genetic drift. Demographic fluctuations are caused by random variations in birth and death rates. Environmental fluctuations include variation in predation, competition, disease, and food supply; and natural catastrophes resulting from single events that occur at irregular intervals, such as fires, floods, earthquakes, storms, or droughts (Primack 1993).

In general, populations of organisms need 50 individuals to avoid inbreeding depression (Franklin 1980), 500 individuals to avoid long-term loss of genetic variation (Franklin 1980, Lande and Barrowclough 1987), and 5,000 individuals to maintain potentially adaptive variation for the long term (Lande 1995). Various studies have investigated the minimum number of salmonids necessary to avoid the high risk of extinction associated with small populations. Allendorf et al. (1997) concluded that salmon populations below 2,500 individuals are at a high risk of extinction, and salmon populations below 250 are at an even greater risk. Given the low population estimates of Chinook and coho salmon in the Mattole Basin, Mattole salmon populations are likely at a high risk of extinction.

MSG has also conducted downstream migrant trapping in the lower mainstem Mattole near Mill Creek, at RM 2.9, in the spring and early summer to monitor the timing of down-migration and to document the size of emigrating salmonid juveniles since 1985. The number of fish caught cannot be construed as a fish population estimate because of unknown trap efficiency and avoidance of the trap by fish at high flows. Data from 1995-2001 indicate that the majority of salmonids trapped were steelhead trout, followed by Chinook salmon and coho salmon (Figure 7and Figure 8) MSG started another downstream migrant trap on Bear Creek 300 ft upstream from its confluence with the Mattole River in 1997. The confluence of Bear Creek and the Mattole River is at RM 42.8. Data from the trap on Bear Creek also show that more steelhead trout are caught than Chinook salmon and coho salmon (

Figure 9 and Figure 10). A third fish trap was placed on the mainstem Mattole River at Ettersburg in 2001 (RM 42.9). This trap caught 1,923 Chinook salmon, 6 coho salmon, 4,863 young-of-the-year steelhead trout, 541 steelhead trout 1+, and 33 steelhead trout smolts.

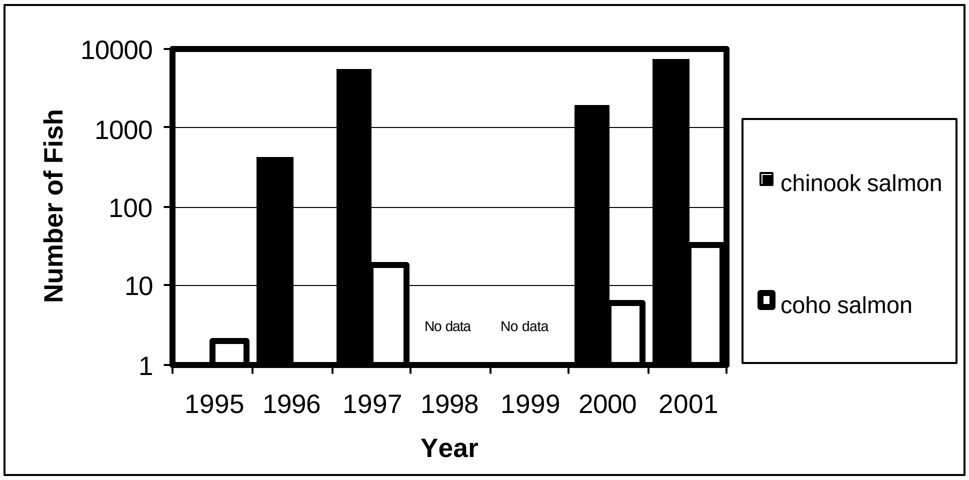


Figure 7. Outmigrant Chinook and coho salmon trapped by the Mattole Salmon Group in the spring and early summer in the Mattole River near Mill Creek (RM 3.0) from 1995-2001. *Data provided by the Mattole Salmon Group.*

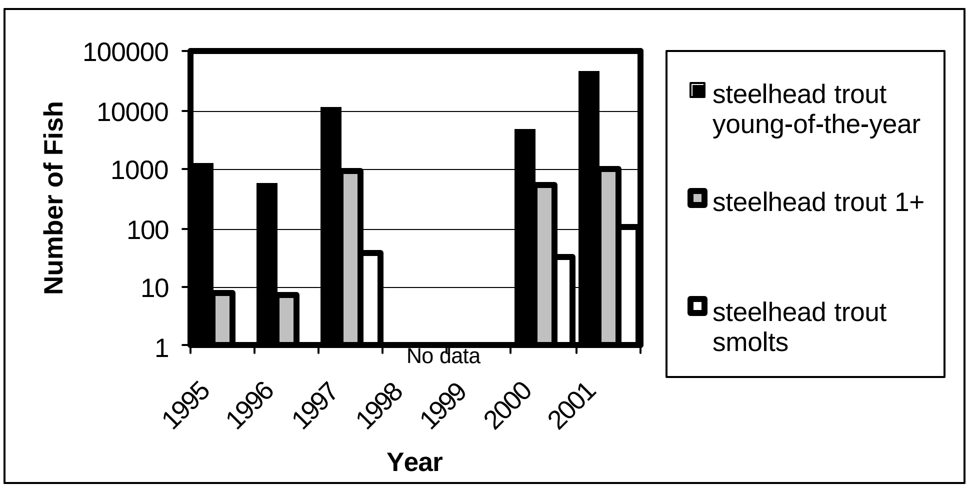


Figure 8. Outmigrant steelhead trout trapped by the Mattole Salmon Group in the spring and early summer in the Mattole River near Mill Creek (RM 3.0) from 1995-2001.

Steelhead were separated into young-of-the-year, 1+, and smolts. Data provided by the Mattole Salmon Group.

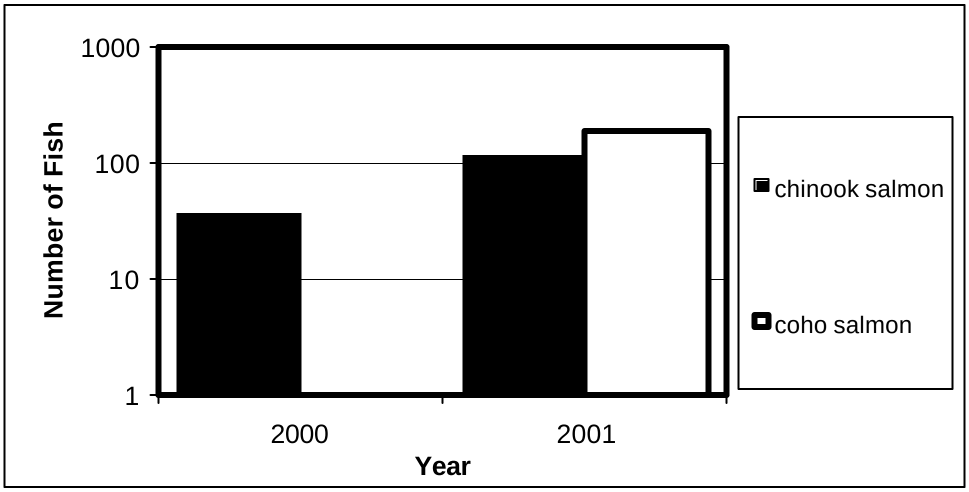


Figure 9. Outmigrant Chinook and coho salmon trapped by the Mattole Salmon Group in the spring and early summer in Bear Creek 300 ft from its confluence with the Mattole River from 2000-2001.

Data provided by the Mattole Salmon Group.

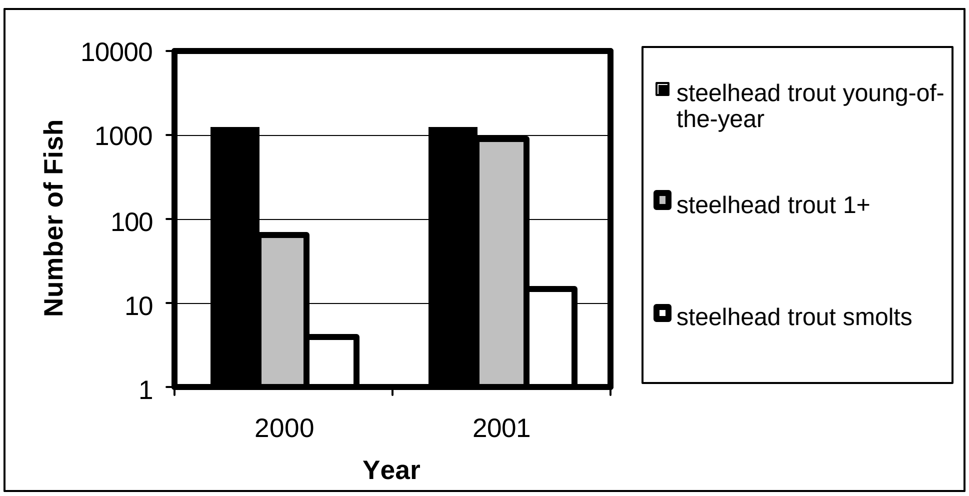


Figure 10. Outmigrant steelhead trout trapped by the Mattole Salmon Group in the spring and early summer in Bear Creek 300 ft from its confluence with the Mattole River from 2000-2001.

Steelhead were separated into young-of-the-year, 1+, and smolts. Data provided by the Mattole Salmon Group.

MSG and CDFG work to maintain and enhance the native fall-run Chinook salmon and coho salmon in the Mattole Basin through a hatchbox program and a rescue-rearing program. The goal of these programs is to restore native salmon runs to self-sustaining levels that can be maintained without artificial propagation or other significant human intervention. MSG is part of the CDFG Cooperative Fish Rearing Project.

Beginning in 1981, MSG has trapped wild adult Chinook and coho salmon in the Mattole Basin for use as broodstock. Eggs are obtained from females and fertilized. Fertilized eggs are incubated in hatchboxes. After hatching, fry are reared for 6 weeks before release. Over 350,000 hatchbox fish had been released by 1999 (Figure 11). All artificially propagated fish are marked, in order to provide estimates of hatchery-to-wild ratios. Adult trapping data from 1995 to 1999 suggest an overall hatchery-to-wild ratio of 1:10, and spawning ground surveys over the same time period suggest a hatchery-to-wild ratio of 1:33.

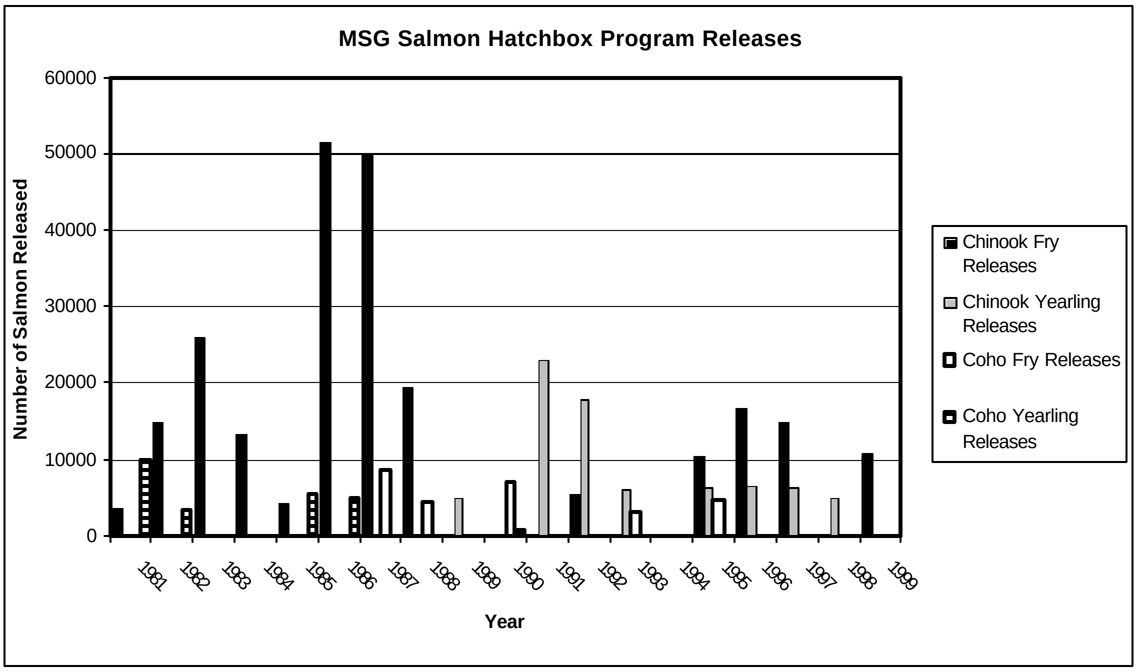


Figure 11. Mattole Salmon Group Hatchbox Program Salmon Releases from 1981-1999. Data provided by the Mattole Salmon Group.

For the past several years in May and June, MSG has also trapped Chinook outmigrants just upstream of the estuary. Extensive studies from 1985-92, led by Humboldt State University, found that Chinook juveniles were suffering lethal impacts during summer rearing in the estuary. Therefore, MSG project personnel and volunteers net up to 6,000 naturally spawned outmigrant juvenile Chinook salmon each year and hold them in rearing ponds at Mill Creek. Volunteers rear the fish until water temperatures drop and/or the lagoon opens to the sea with fall rains. The combined number of Chinook salmon released from the MSG's hatchbox rearing program and their rescue-rearing program since 1981 is approximately 400,000.

Review of Available Data by Subbasin

Estuary

Introduction

Because of the Mattole Estuary's importance to healthy salmonid populations, many studies have been carried out there. Busby et al. prepared a report on the natural resources of the Mattole Estuary for the Bureau of Land Management (BLM) in 1988, and Busby and Barnhart had a paper in California Fish and Game in 1995. In addition, studies conducted by researchers from Humboldt State University (HSU) in the 1980s and early 1990s resulted in four Masters theses concerning salmonids in the estuary (Young 1987, Busby 1991, Zedonis 1992, and Day 1996).

The Mattole Estuary is a seasonal bar built estuary. It acts both as an estuary and as a lagoon throughout the course of the year. In the early summer of most years, a sand bar encroaches all the way across the mouth of the Mattole River to form a bay barrier and create a lagoon behind it. The formation of the bar is caused by a combination of sediment deposition from coastal long shore ocean currents, and decreased river flows. Lagoon formation typically occurs in late May or early June, although the mouth may remain open until mid or late June when adequate flows are present, as was the case in 1986 (Table 14). On the other hand, in extremely dry years, closure will take place earlier. The lagoon opens up again in the fall, usually in October, due to erosion of the sand bar from increased river flow and wave action (Busby et al. 1988).

Table 14. The timing and duration of Mattole River mouth closures and associated river discharge at initial closure.

Data provided by MSG.

Year	Date of Initial Mouth Closure (Month/Day)	Discharge at Initial Mouth Closure at the USGS Petrolia Gage* (cfs)	Number of Close/Open Cycles	Total Number of Days Closed	Approximate Date of Final Sandbar Breaching (Month/Day)
1981	NA**	NA	NA	NA	9/27
1982	Early to mid July	~80	NA	~120	~10/31
1983	-------------------The mouth did not close in 1983-------------------				
1984	Early July	~100	1	~92	10/11
1985	6/28	65	1	~115	~10/22
1986	6/23	108	2	~126	~10/30
1987	5/26	133	1	~135	~10/8
1988	7/21	63	1	104	11/3
1989	8/4	44	1	79	10/23
1990	9/8	49	1	53	10/31
1991	7/4	67	6	53	11/17
1992	6/11	104	2	97	10/1
1993	8/10	79	2	96	11/29
1994	7/8	89	1	120	11/5
1995	7/16	102	2	138	12/1
1996	7/9	115	3	131	11/17
1997	6/21	122	2	103	10/2
1998	7/21	77	2+	109	11/7
1999	6/24	NA	2+	126	10/28

* The USGS Petrolia gauging station (No. 11469000) is located about 5.2 river miles upstream from the mouth of the Mattole River. Flows at the Mattole mouth can be estimated by multiplying the gauging station value by 1.15 to account for tributary inflows downstream from the gage.

** NA = Data not available.

The Mattole Lagoon floods an area of approximately 3 hectares with the deepest sections occurring in the main channel of the river. The size and depth of the lagoon fluctuate throughout the summer, with the lagoon shrinking towards the end of the summer due to decreased river flow, increased evaporation, and increased seepage through the sand bar. Annual variations in lagoon size occur due to scouring in some areas and sediment deposition on others. Although the extent of tidal influence in the lagoon has not been quantified, tides are thought to have a minimal effect on the water level of the lagoon. Before the lagoon closes, seawater intrusion is thought to extend only 984 feet above the mouth of the river. Shortly after lagoon closure, incoming river water and wind driven mixing cause the lagoon to become essentially freshwater. Intense and persistent winds cause vigorous mixing throughout the water column. HSU researchers completed a map of habitat types found in the Mattole Estuary following the United States Fish and Wildlife Service's (USFWS) classification system of wetlands and deepwater habitats using aerial photographs and ground observations. The original map is on file at the USFWS, California Cooperative Fishery Research Unit, Humboldt State University, Arcata (Busby et al. 1988).

General Biology

The Mattole Estuary Subbasin provides habitat for a large number of plants, birds, reptiles, amphibians, and mammals as well as fish and aquatic invertebrates. Plant species found in the Estuary Subbasin include dune vegetation such as beach pea and beach layia, which is federally and state listed as endangered; riparian trees such as red alder and elderberry; and wildflowers such as the California poppy and lupine (Table 15). There are also a number of introduced plants in this subbasin, such as ice plant, windmill pink, and milk thistle. The estuary and surrounding riparian vegetation provide feeding, nesting, rearing, and/or refuge habitat for many species of birds including osprey, bald eagles, herons, hummingbirds, and sandpipers (Table 16). No complete list of reptiles and amphibians specific to the estuary has been compiled, but HSU researchers have observed fence lizards, alligator lizards, gartersnakes, rattlesnakes, gophersnakes, salamanders, and frogs (Table 17). The estuary and surrounding riparian vegetation also provide suitable habitat for terrestrial, riverine, and marine mammals. These include Columbian blacktail deer, blacktail jackrabbits, harbor seals, and stellar sea lions (Table 18) (Busby et al. 1988).

Table 15. List of plant taxa identified in the Mattole Estuary and surrounding riparian areas (Busby et al. 1988).

** I indicates that a species is introduced and non-native.*

Common Name	Scientific Name
Horsetails	*Equisetum sp .*
Ferns	Pterophyta
Ice plant*I	*Mesembryanthemum sp.*
Sea purslane	*Sesuvium sp.*
Poison oak	*Toxicodendron diversiloba*
Red alder	*Alnus oregona*
Elderberry	*Samacus sp.*
Windmill pink*I	*Silene gallica*
Indian pink	*Silene california*
Monterey cypress	*Cypressus sp.*
Yarrow	*Achillea millifotlium*
California mugwort	*Artemesia douglasiana*
Coyote brush	*Baccharis pilularis*
Seaside daisy	*Erigeron glaucus*
Gummy sunflower	*Grindelia stricata*
Beach layia	*Layia carnosa*
Hawkbit*I	*Leontodon taraxacoides*
Milk thistle*I	*Silybum marianum*
Ragweed	*Ambrosia chamissonis*
Fire weed*I	*Erechtites sp.*
Live-forever	*Dudleya sp.*
Mustard	*Brassica capestris*
Sea rocket	*Cackile edentula*
Sea rocket*I	*Cackile maritima*
Point Reyes Wallflower	*Erysimum conicinnum*
Radish*I	*Rhaphanus sp.*
Man root or Western cucumber	*Marah oreganos*
Silk tassel	*Garrya ellipticata*
Magenta Butterfly Flower	*Stachys chamissonis*
Hedgenettle	*Stachys rigida*
Beach pea	*Lathyrus littoralis*
Birds-feet trefoil*I	*Lotus coriculatis*
Lupine	*Lupinus albifrans*
Lupine	*Lupinus bicolor*
Sour clover	*Trifolium fucatum*

Common Name	Scientific Name
Clover	*Trifolium wormskioldi*
Vetch	*Vicia sp.*
Maple-leaved checkerbloom	*Sidalcea malachroides*
Sand verbana	*Abronia latifolia*
Satin flower, Farewell-to-spring	*Clarkia amoena*
San Francisco Willow Herb	*Epilobium watsonii franciscanum*
Willow Herb	*Epibolium sp.*
Wood sorrel	*Oxalis sp.*
California poppy	*Eschsholzia californica*
Douglas fir	*Pseudotsuga taxofolia*
Plantain	*Plantago hirtella*
English plantain*I	*Plantago lancelata*
Globe Gilia	*Gilia capitata*
Bird's-eyes, Tricolor Gilia, Birds-eye Gilia	*Gilia tricolor*
California buttercup	*Ranunculus californicum*
Ceanothus	*Ceanothus sp.*
Cream bush	*Holodiscus discolor*
Five finger	*Potentilla egedei*
Willow	*Salix sp.*
Buckeye	*Aesculus californica*
Canyon Gooseberry	*Ribes menziesii*
Bush monkey flower	*Mimulus avrantiacus*
Common monkey flower	*Mimulus gluttatus*
Owl's clover	*Orthocarpus sp.*
Figwort	*Scrophularia californicus*
Paintbrush	*Castilleja sp.*
Cow parsnip	*Heraclium lanatum*
Poison hemlock*I	*Conium maculatum*
Water Parsley	*Oenanthe sarmentosa*
Saltgrass	*Distichlis spicata*
Sweet grass	*Anthoxanthum aristatum*
Wild oats*I	*Avena barbata*
Reed grass	*Calamagrastis nutkaensis*
Leafy reed grass	*Calamagrostis foliosa*
Common velvet grass, Yorkshire fog*I	*Holcus lanatus*
Ripgut brome*I	*Bromus diandrus*
Soft chess*I	*Bromus mollis*
Sedge	*Carex obnupta*
Common spike-rush	*Heleocharis palustris*
Galingale	*Cyperus sp.*
Hedgehog Dogtail*I	*Cynosurus echinatus*
Bluegrass	*Poa douglasii*
Flag	*Iris douglasiana*
Bog rush	*Juncas effusus*
Rush	*Juncas sp.*
Meadow barley	*Hordeum brachyantherum*

Table 16. Bird species observed in the Mattole Estuary/Lagoon (Busby et al. 1988).

** I indicates that a species is introduced and non-native.*

Common Name	Scientific Name
Red-throated loon	*Gavia stellata*
Artic loon	*Gavia arctica*
Common loon	*Gavia immer*
Pie-billed grebe	*Podilymbus podiceps*
Horned grebe	*Podiceps auritus*
Red-necked grebe	*Podiceps grisegena*
Eared grebe	*Podiceps nigricollis*
Western grebe	*Aechmophorus occidentalis*
Brown pelican	*Pelecanus occidentalis*
Double-crested cormorant	*Phalacrocorax auritus*
Brandt's cormorant	*Phalacrocorax penicillatus*
Pelagic cormorant	*Phalacrocorax pelagicus*
Great blue heron	*Ardea herodias*

Common Name	Scientific Name
Great egret	*Ardea alba*
Green-backed heron	*Butorides virescens*
Black-crowned night heron	*Nycticorax nycticorax*
American bittern	*Botaurus lentiginosus*
Whistling swan	*Olor columbianus*
Snow goose	*Chen caerulescens*
Brant	*Branta bernicla*
Canada goose	*Branta canadensis*
Wood duck	*Aix sponsa*
Green-winged teal	*Anas crecca*
Pintail	*Anas acuta*
Mallard	*Anas platyrhynchos*
Northern shoveler	*Anas clypeata*
Gadwall	*Anas strepera*
American wigeon	*Anas americana*
Canvasback	*Aythya valisineria*
Redhead	*Aythya americana*
Ring-necked duck	*Aythya collaris*
Greater scaup	*Aythya marila*
Lesser scaup	*Aythya affinis*
Harlequin duck	*Histrionicus histrionicus*
Black scoter	*Melanitta nigra*
Surf scoter	*Melanitta perspicillata*
White-winged Scoter	*Melanitta fusca*
Common Goldeneye	*Bucephala clangula*
Bufflehead	*Bucephala albeola*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Ruddy Duck	*Oxyura jamaicensis*
Osprey	*Pandion haliaetus*
Bald Eagle	*Haliaeetus leucocephalus*
Golden Eagle	*Aquila chrysaetos*
Northern Harrier	*Circus cyaneus*
Sharp-shinned Hawk	*Accipiter striatus*
Cooper's Hawk	*Accipiter cooperii*
Red-shouldered Hawk	*Buteo lineatus*
Red-tailed Hawk	*Buteo jamaicensis*
American Kestrel	*Falco sparverius*
Merlin	*Falco columbarius*
Peregrine Falcon	*Falco peregrinus*
Prairie Falcon	*Falco mexicanus*
California Quail	*Callipepla californica*
Virginia Rail	*Rallus limicola*
American Coot	*Fulica americana*
Sora	*Porzana carolina*
Black-bellied Plover	*Pluvialis squatarola*
Snowy Plover	*Charadrius alexandrinus*
Semipalmated Plover	*Charadrius semipalmatus*
Killdeer	*Charadrius vociferus*
Black Oystercatcher	*Haematopus bachmani*
Greater Yellowlegs	*Tringa melanoleuca*
Willet	*Catoptrophorus semipalmatus*
Wandering Tattler	*Heteroscelus incanus*
Black Turnstone	*Arenaria melanocephala*
Ruddy Turnstone	*Arenaria interpres*
Spotted Sandpiper	*Actitis macularia*
Whimbrel	*Numenius phaeopus*
Marbled Godwit	*Limosa fedoa*
Surfbird	*Aphriza virgata*
Sanderling	*Calidris alba*
Western Sandpiper	*Calidris mauri*
Baird's Sandpiper	*Calidris bairdii*
Rock Sandpiper	*Calidris ptilocnemis*
Dunlin	*Calidris alpina*
Short-billed Dowitcher	*Limnodromus griseus*

Common Name	Scientific Name
Long-billed Dowitcher	*Limnodromus scolopaceus*
Common Snipe	*Gallinago gallinago*
Red-necked Phalarope	*Phalaropus lobatus*
Red Phalarope	*Phalaropus fulicaria*
Bonaparte's Gull	*Larus philadelphia*
Heermann's Gull	*Larus heermanni*
Mew Gull	*Larus canus*
Ring-billed Gull	*Larus delawarensis*
California Gull	*Larus californicus*
Black-headed Gull	*Larus ridibundus*
Herring Gull	*Larus argentatus*
Thayer's Gull	*Larus thayeri*
Western Gull	*Larus occidentalis*
Glaucous-winged Gull	*Larus gla ucescens*
Black-legged Kittiwake	*Rissa tridactyla*
Caspian Tern	*Sterna caspia*
Common Tern	*Sterna hirundo*
Forster's Tern	*Sterna forsteri*
Common Murre	*Uria aalge*
Pigeon Guillemot	*Cepphus columba*
Marbled Murrelet	*Brachyramphus marmoratus*
Ancient Murrelet	*Synthliboramphus antiquus*
Rhinoceros Auklet	*Cerorhinca monocerata*
Mourning Dove	*Zenaida macroura*
Western Screech-Owl	*Otus kennicottii*
Great Horned Owl	*Bubo virginianus*
Northern Pygmy-Owl	*Glaucidium gnoma*
Anna's Hummingbird	*Calypte anna*
Allen's Hummingbird	*Selasphorus sasin*
Belted Kingfisher	*Ceryle alcyon*
Acorn Woodpecker	*Melanerpes formicivorus*
Red-breasted Sapsucker	*Sphyrapicus ruber*
Downy Woodpecker	*Picoides pubescens*
Hairy Woodpecker	*Picoides villosus*
Northern Flicker	*Colaptes auratus*
Western Wood-Pewee	*Contopus sordidulus*
Hammond's Flycatcher	*Empidonax hammondii*
Pacific-slope Flycatcher	*Empidonax difficilis*
Black Phoebe	*Sayornis nigricans*
Ash-throated Flycatcher	*Myiarchus cinerascens*
Purple Martin	*Progne subis*
Tree Swallow	*Tachycineta bicolor*
Violet-green Swallow	*Tachycineta thalassina*
Rough-winged Swallow	*Stelgidopteryx ruficolliss*
Cliff Swallow	*Petrochelidon pyrrhonota*
Barn Swallow	*Hirundo rustica*
Scrub-Jay	*Aphelocoma coerulescens*
American Crow	*Corvus brachyrhynchos*
Common Raven	*Corvus corax*
Chestnut-backed Chickadee	*Poecile rufescens*
Bushtit	*Psaltriparus minimus*
Red-breasted Nuthatch	*Sitta canadensis*
Bewick's Wren	*Thryomanes bewickii*
House Wren	*Troglodytes aedon*
Winter Wren	*Troglodytes troglodytes*
Marsh Wren	*Cistothorus palustris*
American Dipper	*Cinclus mexicanus*
Ruby-crowned Kinglet	*Regulus calendula*
Western Bluebird	*Sialia mexicana*
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
Varied Thrush	*Ixoreus naevius*
Water Pipit	*Anthus spinoletta*
Cedar Waxwing	*Bombycilla cedrorum*

Common Name	Scientific Name
European Starling * I	*Sturnus vulgaris*
Solitary Vireo	*Vireo solitarius*
Hutton's Vireo	*Vireo huttoni*
Warbling Vireo	*Vireo gilvus*
Orange-crowned Warbler	*Vermivora celata*
Nashville Warbler	*Vermivora ruficapilla*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler	*Dendroica coronata*
Townsend's Warbler	*Dendroica townsendi*
MacGillivray's Warbler	*Oporornis tolmiei*
Common Yellowthroat	*Geothlypis trichas*
Wilson's Warbler	*Wilsonia pusilla*
Yellow-breasted Chat	*Icteria virens*
Western Tanager	*Piranga ludoviciana*
Black-headed Grosbeak	*Pheucticus melanocephalus*
Lazuli Bunting	*Passerina amoena*
Rufous-sided Towhee	*Pipilo erythrophthalmus*
Lark Sparrow	*Chondestes grammacus*
Fox Sparrow	*Passerella iliaca*
Song Sparrow	*Melospiza melodia*
Lincoln's Sparrow	*Melospiza lincolnii*
Golden-crowned Sparrow	*Zonotrichia atricapilla*
Red-winged Blackbird	*Agelaius phoeniceus*
Dark-eyed Junco	*Junco hyemalis*
Brown-headed Cowbird	*Molothrus ater*
Baltimore Oriole	*Icterus galbula*
Purple Finch	*Carpodacus purpureus*
House Finch	*Carpodacus mexicanus*
Pine Siskin	*Carduelis pinus*
Evening Grosbeak	*Coccothraustes vespertinus*

Table 17. Species of reptiles and amphibians observed or collected in the Mattole Estuary/Lagoon and surrounding riparian vegetation 1986-November 1987 by HSU researchers (Busby et al. 1988).

Common Name	Scientific Name
Reptiles	
Western Fence Lizard	Sceloporus occidentalis
Northern Alligator Lizard	*Gerrhonotus coeruleus*
Common Garter Snake	*Thamnophis sirtalis*
Western Rattlesnake	*Crotalus viridis*
Pacific Gopher Snake	*Dituophis catenifer*
Western Terrestrial Gartersnake	*Thamnophis elegans*
Western Terrestrial Aquatic Gartersnake	*Thamnophis couchi*
Amphibians	
Pacific Giant Salamander	*Dicamtodon ensatus*
California Slender Salamander	*Batrachoseps attenuatus*
Pacific Tree Frog	*Hyla regilla*
Bull Frog	*Rana cates beiana*

Table 18. Species of mammals observed in the Mattole Estuary/Lagoon and surrounding riparian vegetation May 1984-November 1987 by HSU researchers (Busby et al. 1988).

** I indicates that a species is introduced and non-native.*

Common Name	Scientific Name	Terrestrial	Riverine	Marine
Opossum *I	*Didelphis virginiana*	X		
Bat	Unknown probably *Myotis sp.*	X		
Raccoon	*Procyon lotor*	X	X	
Ringtail	*Bassariscus astutus*	X		
River otter	*Lontra canadensis*		X	
Striped skunk	*Mephitis mephitis*	X		
Coyote	*Canis latrans*	X		
Gray fox	*Urocyon cinereoargenteus*	X		
Bobcat	*Lynx rufus*	X		
Steller sea lion	*Eumetopias jubatus*			X
Harbor seal	*Phoca vitulina*			X
California ground squirrel	*Spermophilus beecheyi*	X		
White footed mice	*Peromyscus sp.*	X		
Dusky footed woodrat	*Neotoma fuscipes*	X		
Porcupine	*Erethizon dorsatum*	X		
Blacktail jackrabbit	*Lepus californicus*	X		
Brush rabbit	*Sylvilagus bachmani*	X		
Columbian blacktail deer	*Odocoileus hemionus columbianus*	X		

HSU Salmonid Studies

Intensive fish surveys were conducted in the Mattole Estuary from 1984 –1992 by HSU researchers (Figure 12, Figure 13). These studies focused mainly on the distribution, abundance, and food habits of juvenile salmonids. Most fish collections were made using a 54.7 x 4.8 m beach seine with 6.4 mm mesh set from a 4.3 m aluminum boat with a 25 horsepower outboard motor (Busby et al. 1988); however, snorkel surveys of the estuary were conducted in 1991 and 1992 (Day 1996). Researchers also examined the benthic and planktonic macroinvertebrates present in the estuary and water quality parameters. Benthic macroinvertebrates were collected using an Ekman sampler and basket-type substrate samplers; and planktonic invertebrates were collected by dragging a 0.5 m diameter plankton net with 0.333-mm mesh at mid-depth along a 300-m transect (Busby 1991). Water quality parameters collected included water temperature, dissolved oxygen, pH, and turbidity (Zedonis 1992). Water quality data for the Mattole Estuary is summarized in the North Coast Regional Water Quality Control Board Appendix.

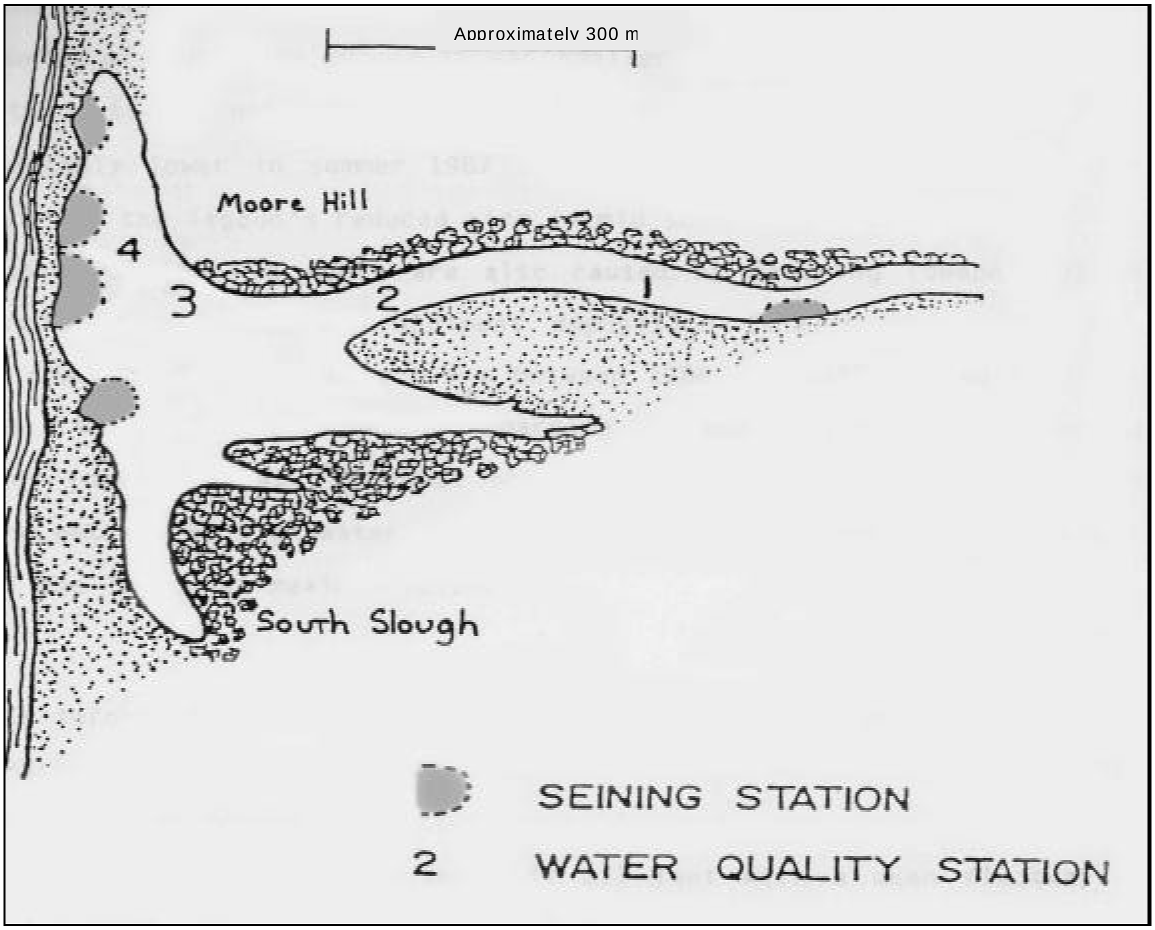


Figure 12. Mattole River lagoon showing beach seining and water quality stations used by HSU researchers (Busby et al. 1988).

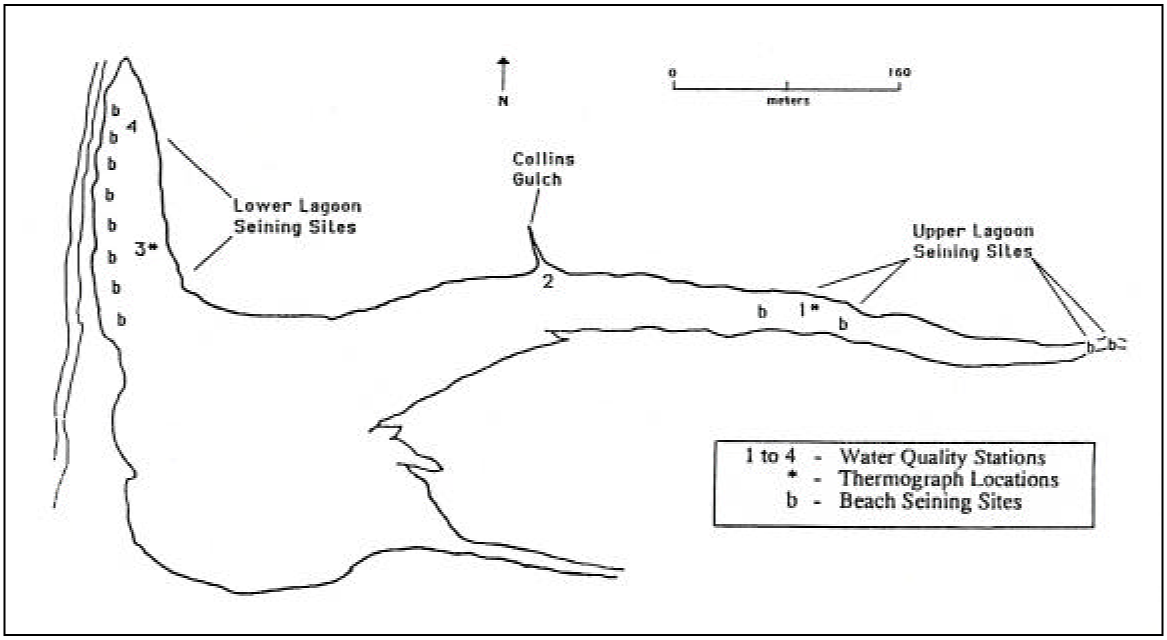


Figure 13. Mattole Lagoon showing upper and lower beach seining sites, thermograph locations, and water quality stations used in 1988 and 1989 (Zedonis 1992).

Several species of freshwater and marine fish were caught in the estuary/lagoon while sampling juvenile salmonids (Table 19). Steelhead trout, Chinook salmon, and threespine stickleback were the most abundant fish species caught. Planktonic invertebrates collected included large numbers of mysid shrimp, gammarid amphipods, a marine/estuarine copepod, and terrestrial insects. Gammarid amphipods, isopods, and caddisfly larvae were the most common benthic macroinvertebrates collected (Table 20) (Busby et al. 1988, Busby 1991).

Table 19. Fish species collected in the Mattole Estuary/lagoon by HSU researchers from May 1984 to November 1987 (Busby et al. 1988).

Common Name	Scientific Name	Anadromous	Freshwater	Marine
Pacific lamprey	*Lampetra tridentatus*	X		
Coho salmon	*Oncorhynchus kisutch*	X		
Chinook salmon	*Oncorhynchus tshawytscha*	X		
Steelhead trout	*Oncorhynchus mykiss*	X		
Surf smelt	*Hypomesus pretiosus*	X		
Threespine stickleback	*Gasterosteus aculeatus*		X	X
Redtail surf perch	*Amphistichus rhodoterus*			X
Shiner perch	*Cymatogaster aggregata*			X
Walleye surf perch	*Hyperprosopon argenteum*			X
Coastrange sculpin	*Cottus aleuticus*		X	
Prickly sculpin	*Cottus asper*			X
Pacific staghorn sculpin	*Leptocottus armatus*			X
Speckled sanddab	*Citharichthys stigmeus*			X
Starry Flounder	*Platichthys stellatus*			X

Table 20. A preliminary list of invertebrates collected by HSU researchers during the 1986-1987 study periods Mattole Estuary/Lagoon (Busby 1991).

Common Name	Scientific Name
Planarians	Tricladia
Roundworms	Nematoda
Oligochaete worms	Oligochaeta
Sludge Worms	Tubificidae
Snails, Limpets	Gastropoda

Common Name	Scientific Name
Olive Shells	Olividae
Purple Dwarf Olive	*Olivella biplicata*
Spiders, Mites, Ticks	Arachnida
Aquatic Mites	Hydracarina
Mussel and Seed Shrimp	Ostracoda
Copepods	Copepoda
	Acartia clausi
	Cyclops sp.
Opossum shrimp	*Neomysis mercedis*
Isopods	Isopoda
	Gnorimosphaeroma oregoniensis
	Poricello sp.
Amphipod	Amphipoda
	Corophium spinicorne
	Eogammarus confervicolus
Beetles	Coleoptera
Leaf Beetles, Flea Beetles, Rootworms	Chrysomelidae
Predaceous Diving Beetles	Dytiscidae
	Oreodytes sp.
Riffle Beetles	Elmidae
	Heterolimnius sp
	Zaitzevia sp.
Water Scavenger Beetles	Hydrophilidae
True Flies	Diptera
Midges	Chironomidae
Mosquitoes	Culicidae
Blackflies	Simullidae
Crane Flies	Tipulidae
Mayflies	Ephemerpotera
	Baetis sp.
	Serratella sp.
	Stenonema sp.
	Paraleptophlebia sp.
	Isonychia sp.
	Tricorythodes sp.
True Bugs	Hemiptera
Water Boatmen	Corixidae
Creeping Waterbugs	Naucoridae
	Pelocris sp.
Cicadas, Leafhoppers, Aphids, Scales	Homoptera
Cicads	Cicadellidae
Ants, Bees, Wasps	Hymenoptera
Ants	Formicidae
Dobsonflies, Alderflies	Megaloptera
Alderflies	Sialidae
	Sialis sp.
Damselflies	Zygoptera
	Hetaerina sp.
Dragonflies	Anisoptera
	Anax sp.
Stoneflies	
	Capnia sp.
Caddisflies	Trichoptera
	Ithytrichia sp.
	Oxyethira sp.
	Lepidostoma sp.
	Dicosmecus sp.
	Gumaga griseus

Threespined Sticklebacks

Threespined sticklebacks are likely the most abundant fish in the Mattole Lagoon in the mid-late summer. Schools of these fish use the warm shallow fringe areas along the edges of the lagoon where submerged riparian vegetation and algal beds are present, although sticklebacks were also observed in deeper parts of the lagoon. Little is known of the stickleback's ecology; however, larval sticklebacks are known to be a food source for juvenile Chinook salmon (Busby et al. 1988).

Chinook Salmon

After the sand bar creating the lagoon is breached in September to November, adult Chinook salmon enter the estuary from the ocean to begin their upstream journey to spawn. They continue to move into the estuary and on to upstream spawning areas through January. Chinook fry emerge from spawning gravels in March and April and begin to move downstream to the estuary. Downstream migration usually peaks in May and is complete in June or the first week of July. It is thought that most juvenile Chinook salmon migrate directly to the ocean and avoid being trapped in the lagoon. The only Chinook salmon remaining in the Mattole River system in the summer are juveniles in the lagoon (Busby et al. 1988).

HSU researchers observed and collected juvenile Chinook salmon in many areas of the Mattole Estuary/Lagoon from 1984-1987 (Figure 14), though they tended to be captured in the deeper areas of the lower lagoon. The number of Chinook salmon captured by beach seining in the lagoon varied annually from a low of 229 in 1984 to a high of 6,672 in 1985 (Table 21).

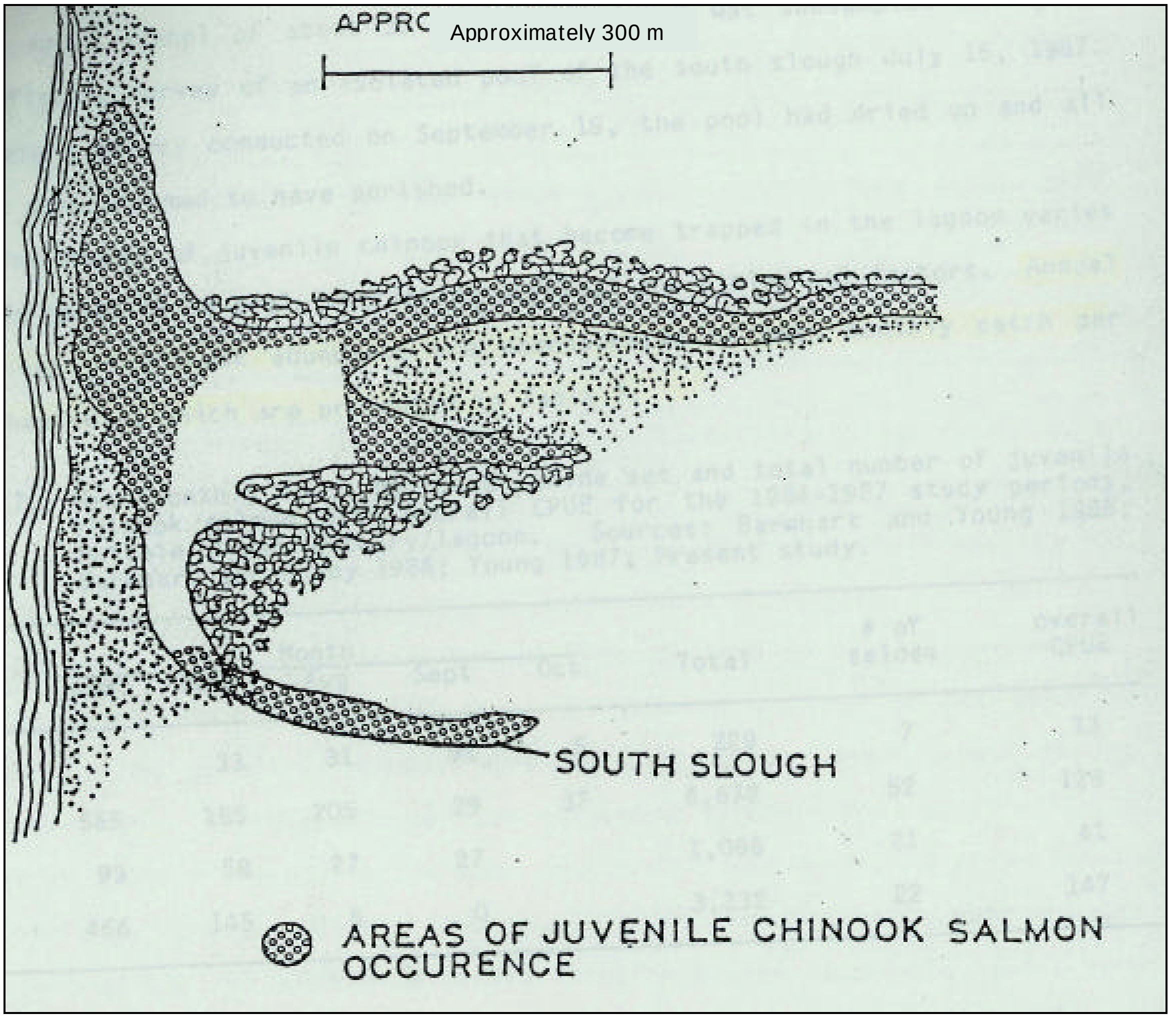


Figure 14. Distribution of juvenile Chinook salmon in the Mattole Estuary/Lagoon May 1984-November 1987.

Includes direct observations, beach and hand seine collections and boat or back-pack electro-fishing surveys (Busby et al. 1988).

Table 21. Mean monthly catch per beach seine set and total number of juvenile Chinook salmon with overall catch per unit effort (CPUE) in the Mattole Estuary/Lagoon for the 1984-1987 study periods (Busby et al. 1988).

Year	Month					Total	Number of Seines	Overall CPUE
	June	July	August	September	October			
1984		33	31	91	5	229	7	33
1985	565	185	205	29	37	6,672	52	128
1986	99	58	27	27		1,066	21	41
1987	466	145	5	0		3,232	22	147

HSU researchers made monthly estimates of juvenile Chinook salmon abundance using the Peterson method with the number of fish caught in seines (Table 22) (Busby et al. 1988). Juvenile Chinook salmon abundance and peak abundance differed from year to year. The highest estimated Chinook salmon population was 109,508± 34,937 in June 1987. Within one month of this observation, the estimated population had declined to 32,190± 11,869, and within two months no juvenile Chinook were captured. The following month no Chinook were captured in the lower lagoon; however, 28 Chinook were collected in a 300 meter stretch of the upper lagoon (Busby et al. 1988). Continued seining efforts until 1992 captured very low or no juvenile Chinook salmon (MRC 1995). Since the mid 1990s, Mattole Salmon Group (MSG) snorkel surveys of the Mattole Estuary after mouth closure have detected very low numbers of juvenile Chinook salmon (2000).

Table 22. Comparison of estimated monthly abundances of juvenile Chinook salmon in the Mattole Estuary/Lagoon during the 1985-1987 study interval.

Limits of the 95% confidence interval and mean are given (Busby et al. 1988). The estuary opened on October 11 in 1984, and around October 22,30, and 8 in 1985, 1986, and 1987, respectively.

Year	June	July	August	September	October
1985		40,783 ± 3,393	83,389 ± 29,862	13,786 ± 6,088	5,475 ± 2,410
1986		9,703 ± 3,088	1,962 ± 991		
1987	109,508 ± 34,937	32,190 ± 11,869	0 ± 0	23 ± 1*	

* Population was estimated using the Moran-Zippin multiple pass removal technique with data from boat electrofishing survey conducted September 19,1987. Confidence interval is 79%.

A comparison of the mean fork length of Chinook salmon captured on different dates provides information on general growth trends (Table 23). Years with lower juvenile Chinook salmon abundance (1986) appear to coincide with fast juvenile growth rates. It is thought that juvenile Chinook salmon in the lagoon undergo a period of suppressed growth associated with the decline of abundance throughout the summer. In years of low abundance in the lagoon, growth is not suppressed and salmon appear to attain larger sizes. Additionally, it appears that years with lower juvenile Chinook salmon abundance coincide with higher Chinook salmon survival in the lagoon. Although the juvenile Chinook survival in the lagoon was not calculated in 1984, it was estimated at 6% in 1985, 20% in 1986, and less than 1% in 1987. Therefore, the data indicate that growth and survival in the Mattole lagoon are density dependent (Busby et al. 1988).

Table 23. Mean monthly fork lengths (mm) of juvenile Chinook salmon in the Mattole Estuary/Lagoon during the 1984-1987 study periods.

The final value given for each year is the approximate mean fork length of Chinook salmon entering the ocean (Busby et al. 1988).

Year	May	June	July	August	September	October
1984			81	91	108	119
1985	55	76	81	85	93	107
1986		82	92	100		
1987		74	79	80	85	

Juvenile Chinook salmon collected in 1986 preferentially ate terrestrial insects and hemiptera; and also ate planktonic or drifting prey items such as diving beetles, and diptera. Juveniles depended heavily on terrestrial food sources from drift earlier in the year, and switched to instream sources later in the year. Feeding was mostly near the surface and mid depths. Chinook salmon collected in 1987 preferentially ate Ephemeroptera larvae and terrestrial insects. Juveniles depended more heavily on terrestrial food sources from drift in 1987, and ate more dipterans. There was no indication of epibenthic feeding and the aquatic amphipod *Corophium* was avoided by juvenile Chinook salmon in both years. In years of early estuary closing, it appears that peak periods of zooplankton and drift abundance lag behind peak abundances of juvenile Chinook salmon, contributing to mortality and suppressed growth (Busby 1991).

Sampling and direct observations in the Mattole Estuary revealed that juvenile Chinook salmon preferred cooler, deep water habitats with measurable salinity. This habitat is not common, though historical accounts indicate that the estuary was once much deeper and perhaps larger. Filling of the estuary with suspended and bedload sediments from upstream reduced the ability of the intruding tidal prism to scour and remove this material (Busby 1991).

Steelhead Trout

After the sand bar creating the lagoon is breached in the fall, adult steelhead trout enter the estuary from the ocean to begin their upstream journey to spawn. Steelhead trout move into the estuary and to upstream spawning areas between October and April. Unlike Chinook and coho salmon, not all steelhead trout adults die after spawning. In years when the estuary closes in late May, some adult steelhead trout returning to the ocean are trapped in the lagoon. These adults feed on stickleback and juvenile salmonids but are vulnerable to anglers (Busby et al. 1988).

Large numbers of juvenile steelhead trout utilize the lagoon in the summer. Steelhead trout were the most abundant fish in the lagoon in 1984 and 1986 and were found in all areas of the lagoon and south slough. Direct observations revealed assemblages of young-of-the-year, one year old, and two year old fish feeding along flats, submerged gravel bars, among boulders, and among submerged vegetation. Disturbed fish formed tight schools that swam quickly to the nearest cover. Juvenile steelhead trout in the upper lagoon associated with overhanging vegetation and avoided areas with bare banks (Busby et al. 1988).

HSU researchers made monthly estimates of steelhead trout abundance using the Peterson method with the number of fish caught in seines in 1987 and using the average Chinook salmon to steelhead trout ratio in seine hauls in 1986 (Busby et al. 1988). Steelhead trout population estimates were made in 1988 and 1989 using the Peterson method with the number of fish caught in seines (Zedonis 1992), and steelhead trout population estimates were made in 1991 and 1992 using visual estimation methods from snorkel surveys (Day 1996).

Juvenile steelhead trout abundance confidence intervals were not calculated in 1986. Steelhead trout populations increased from June through August in 1986 (Table 24, Table 25). In 1987, a high steelhead trout population of 32,190 ±11,869 was estimated in June. By August of that year, the estimated population had declined to 4,133±2,005, and by September only four steelhead trout were captured in seine hauls of the lower lagoon and a population of 945±247 was estimated by electrofishing the upper lagoon (Busby et al. 1988).

Table 24. Mean monthly catch of steelhead trout per beach seine set, total catch, and overall catch per unit effort (CPUE) in the Mattole Estuary/Lagoon for the 1984-1987 study periods (Busby et al. 1988).

Year	Month						Total	Number of Seines	Overall CPUE
	June	July	August	September	October	November			
1984		404	639	1,128	427		4,067	7	581
1985	158	180	193	48	86		5,686	52	109
1986	140	178	327				5,421	21	258
1987	30	150	28	2		1	1,276	22	58

Table 25. Comparison of estimated monthly abundances of juvenile steelhead trout in the Mattole Estuary/Lagoon during the 1986-1987 study interval (Busby et al. 1988) and the 1988-1989 study interval (Zedonis 1992).

Confidence intervals were not calculated in 1986. The estuary opened around October 30, 1986; around October 8, 1987; on November 3, 1988; and on October 23, 1989.

Year	June	July	August	September	October
1986	15,000	29,000	49,000		
1987	1,088 ±488	32,190 ±11,869	4,133 ±2,005	945 ±247	
1988		23,623 ±6,029	24,208 ±3,603	27,490 ±3,269	185,582±120,137
1989			39,519 ±5,932	30,653 ±3,845	17,484 ±2,453

Electrofishing of the south slough was conducted on July 15, 1987. Juvenile steelhead trout were collected; however, these were thought to have perished as subsequent electrofishing efforts on September 19, 1987 did not find any steelhead trout. One adult female steelhead did survive summer isolation and was captured in the uppermost pool of the slough on both electrofishing surveys. This pool had approximately 90% shade canopy provided by alders and temperatures remained between 12.2 and 15.0°C (Busby et al. 1988).

Population estimates in 1988 indicated that the number of juvenile steelhead trout remained constant from late July to August, but increased in late September and October (Table 25). The large increase to 185,582 individuals in October was probably an overestimate caused by using an ambiguous marking technique. The number of steelhead trout utilizing the lower lagoon appeared to decline over the summer in 1988. The number of individuals utilizing the entire lagoon appeared to decline over the summer in 1989. It appeared that juveniles were migrating to the upper lagoon area in 1989. This shift can probably be attributed to changes in the salinity and temperature of the lower lagoon as the amount of saltwater overwash into the lower lagoon was substantial in 1989 (Zedonis 1992). Additionally, dense algae mats could have decreased the amount of dissolved oxygen present in the lower lagoon on some nights as occurred in 1987 (Barnhart et al. 1988, Zedonis 1992).

Snorkel surveys conducted from May 1991 through October 1992 showed the number of steelhead trout to vary from less than 24 in May of 1991 to over 5,000 in September 1992 (

Table 26). These were direct counts, so no confidence intervals were calculated. In this time, water temperatures were found to exceed the lethal limit of 75ºF, which suggests that steelhead trout in the Mattole Estuary had acclimated to the higher temperatures. An ancillary mainstem Mattole River study in the summer of 1991 found that juvenile steelhead trout habitat was limited to a few areas where cools springs and tributaries were entering the mainstem. Pools were laden with sand and silt, and lacked complexity and structure (Day 1996).

Table 26. Steelhead population estimates made by snorkel surveys in the Mattole Estuary/Lagoon from May 1991-October 1992 (Day 1996).

Date	Condition of River Mouth	Number of Steelhead Trout		
		Upper Estuary/Lagoon	Lower Estuary/Lagoon	Total Estuary
5/28/1991	Open	<25	200	<225
6/11/1991	Open	100	200	300
7/16/1991	Open	100	500	600
8/29/1991	Open	100	1,000	1,100
10/5/1991	Open	100	2,000	2,100
5/24/1992	Open	200	300	500
5/28/1992	Open	200	300	500
6/6/1992	Open	100	300	400
7/9/1992	Open	100	300	400
9/4/1992	Closed	*	2,000	*
9/19/1992	Closed	*	3,000	*
9/26/1992	Closed	100	5,000	5,100
10/18/1992	Open	<25	<25	<50

* High turbidity prohibited estimate.

In 1988 and 1989, a steady decline in the percentage of young-of-the-year steelhead trout captured by beach seining occurred from July through September. An increase occurred in October of 1988 but not in 1989. This coincided with a resurgence of migrating young-of-the-year steelhead trout in 1988. The percentage of age 1+ fish captured in both 1988 and 1989 increased from July to September and decreased in October. The number of age 2+ fish captured was greatest in August and September in 1988, and greatest in July in 1989 (Zedonis 1992).

In both 1988 and 1989, the mean lengths of juvenile steelhead trout utilizing the Mattole Lagoon exceeded those of juveniles studied in riverine habitats for the same time period. This larger size indicated that the lagoon provided productive steelhead trout rearing habitat. Young-of-the-year fish showed continuous growth during the monitoring periods, though yearlings grew slowly in August and September 1988. Reduced yearling growth in 1988 was probably related to high water temperatures. Optimum water temperatures for steelhead trout growth were exceeded more in 1988 than in 1989 (Zedonis 1992).

Juvenile steelhead trout were found to have different diets in the upper and lower lagoons. The major food source in the lower lagoon was the aquatic amphipod *Corophium,* while major food sources in the upper lagoon varied and included trichopteran larvae, aquatic diperans, and *Corophium*. Terrestrial invertebrates comprised a larger portion of the diet of steelhead trout in the lower lagoon than the upper lagoon, though algae and pebbles found in stomachs indicated that fish were primarily exhibiting a benthic feeding strategy throughout the lagoon (Zedonis 1992).

An examination of the life history strategies of Mattole River steelhead trout showed that the dominant portion of returning adults was made up of four-year-old fish that had spent two years in freshwater. Two important early life history strategies were estuary rearing and tributary rearing. Estuary reared fish exhibited higher growth rates prior to entry into the oceanic environment, though growth between the two groups later evened out. Estuary growth was observed for 60% of the individuals examined, suggesting that steelhead trout with an estuarine residency comprise a significant portion of the Mattole run (Day 1996).

Estuary Management

Busby et al. (1988) make a number of estuary management recommendations, basin management recommendations, and suggestions to improve habitat conditions for salmonids in the Mattole Estuary/Lagoon. They are presented here verbatim from Busby et al. (1988) and are not necessarily endorsed by NCWAP or any of its member agencies:

Estuary Management Recommendations:

1. Protect the estuary from agricultural use, urban and other development. This may require fencing off the area to exclude stray cattle and maintaining the "conservation area" status of the area.
2. Protect the unique fish and wildlife resources of the estuary. This could be done by implementing a "wildlife refuge" designation for the area with enforcement support.
3. Promote non-degradative recreational uses of the estuary. This includes the continued exclusion of off-highway vehicles, which threaten sensitive and endangered plant species and distract from the area's aesthetics.

Basin Management Recommendations:

1. Identify point and non-point sources of erosion and any toxic pollutants.
2. Set basin-wide standards or goals for sediment load and work with local residents, agriculture, and industry to achieve them within a specified time period.
3. Educate private landowners in techniques that reduce sediment load.
4. Prosecute landowners who abuse the watershed and produce identifiable point sources of erosion.
5. Continue efforts to repair and rehabilitate known point sources of erosion.

Habitat Improvement Suggestions:

1. Estimate Chinook salmon and steelhead trout abundance in early May during low flow years. If populations exceed 25,000 and the estuary appears to be closing, keep it open at least periodically by artificial means until approximately June 15th.
2. If Chinook salmon and steelhead trout exceed 50,000 individuals by late July or early August, open the lagoon to allow out migration. Introduction of saltwater may reduce water temperature and salmonid mortality and help to stimulate increased productivity of the system.
3. If the berm has not breached by October 1, open it to prevent extended lagoon residency.
4. Continue watershed rehabilitation and hatchbox programs.
5. Release fish from rearing programs early or further downriver, possibly in the estuary, to allow a greater opportunity for out migration before estuary closure.
6. Place permanent structures such as logs and boulders in the lagoon, which will serve as traps for organic carbon and provide feeding and refuge areas for juvenile salmonids.
7. Explore the feasibility of adding fish food to the lagoon during periods of peak salmonid abundance, basically using the lagoon as a managed rearing pond.
8. Explore the feasibility of direct ocean release of Mattole imprinted salmonids.

Since 1988, some effort has been made to implement a few of Busby's ideas. HSU researchers continued to investigate conditions in the estuary for salmonids through 1992. Additionally, in the late 1980s, the Mattole Salmon Group obtained funding from CDFG to construct 24 floating structures in the estuary to provide shade and cover for juvenile salmon and steelhead trout; place bank protection and scouring structures in the estuary; and re-vegetate areas of the estuary.

The Mattole Restoration Council (MRC) initiated the Mattole Estuary Enhancement Plan (MEEP) in 1989, following the granting of a contract by the California Coastal Conservancy. The overall goal of this project was to provide a plan to enhance the biological productivity and integrity of the estuary and adjacent corridor of the Mattole River. The original plan outlined nine tasks. They are presented here verbatim from the MEEP (1989) and are not necessarily endorsed by NCWAP or any of its member agencies:

1. **Obtain Aerial Photography:** Mylar enlargements of black and white aerial photographs would be used as a base for mapping.
2. **Surveying and Geomorphic Mapping:** The aerial photographs would be supplemented with surveyed and monumented cross-sections and geomorphic maps would be prepared.
3. **Hydrology and Sediment Transport Analysis:** Discharge data, water temperatures and levels, information on the size and movement of surface bed material and the timing and processes of lagoon closure would be obtained and analyzed.
4. **Downstream Migrant Trapping:** Trapping, sampling, and counting of juvenile salmon and steelhead trout migrating to the ocean would continue. This, as well as other fisheries research will be performed by the Cooperative Fisheries Research Unit of Humboldt State University under the BLM funded program (to 1992).
5. **Development of Re-vegetation Plan:** Areas where natural processes of re-vegetation can be accelerated by planting would be identified. These areas would be ranked by priority and conceptual planting plans developed with recommendations as to specific goals and long-term monitoring and maintenance requirements.
6. **Development of Cold Pool Plan:** Opportunities to create cold pools for increased fish habitat at the upstream margin of the estuary would be identified. Conceptual plans for the creation of cold pools would be developed.
7. **Development of Fencing Plan:** A plan describing appropriate fencing needs would be developed to protect riparian vegetation. The fencing plan would also recommend means by which landowners could be educated as to the benefits of erosion control and a healthy riparian corridor.
8. **Oral History:** Recollections of individuals who remember the Mattole Estuary before major logging in the watershed would be obtained for use in setting realistic goals for estuary enhancement. These statements would be verified where possible by historic photographs and maps.
9. **Development of Technical Advisory, Landowner Advisory, and Project Management Committees:** A technical advisory committee consisting of representatives from agencies with expertise in north coast estuaries and watersheds would be developed to provide technical assistance during the planning process. Additionally, a landowner advisory committee consisting of landowners directly upstream of the estuary would be formed to encourage landowner input and to disseminate important educational information. Finally, a project management committee consisting of representatives from the BLM, the State Coastal Conservancy, Department of Fish and Game, and the Mattole Restoration Council would be formed to oversee plan development.

The MRC's 1995 Report, *Dynamics of Recovery*, is the result of the MEEP. This report summarizes the results of studies conducted in the estuary, evaluates past restoration efforts, and provides recommendations for estuary restoration strategies.

In addition to the estuary studies carried out by HSU researchers, the MRC conducted investigations of the hydrology, geology, and geomorphology of the Mattole Estuary. Hydrology investigations examined precipitation, river discharge, hydraulic geometry, and water temperature. Precipitation and discharge data from *Dynamics of Recovery* are incorporated in the Watershed Profile of the Synthesis Report. Bathymetry studies revealed the dynamic quality of the estuary when gravel bars were observed to scour away and re-form. The depth of pools in the lower Mattole River was tracked from 1991 to 1994. There was an overall trend of pool aggradation in the study period, though pools adjacent to north bank scour structures did not aggrade. Temperature studies found that maximum temperatures in the upper lagoon were as warm or warmer than temperatures in the lower lagoon. The shallow upper lagoon appears to act as a more efficient solar collector than the deeper lower lagoon; and the upper lagoon is more protected from summer's cooling north winds and is thus unable to dissipate the warmth of incoming river water. Colder temperatures were measured in five tributaries entering the lower Mattole River (North Fork Mattole River, Titus Creek, Mill Creek (R.M. 2.8), Stansbery Creek, Bear Creek (lower), and Collins Creek); and in five pools (subsurface flows from Titus Creek, Rex's Wing Dam pool, the mouth of Mill Creek (R.M. 2.8), subsurface flow into the Dogleg pool, and the Collins Rock pool).

Geology and Geomorphology data from *Dynamics of Recovery* are incorporated in the Department of Conservation/California Geological Survey Appendix.

Eight previously completed restoration projects for the lower Mattole River, past re-vegetation work, and live siltation baffles were evaluated. The evaluation of past projects indicated that location and construction are important considerations when installing log and boulder structures in the lower Mattole River. Structures appeared to encourage pool formation best when they were located near scouring flows. Structures appeared to provide over-summering habitat for rearing salmonids best when they extended into the low-flow channel and are built near a cold-water source. In addition, structures appeared to be more stable when they were well keyed into a bank. In terms of construction, massive, complex, messy structures made of native materials such as Douglas fir or redwood or large boulders were the best. Additionally, structures were more durable when they were built high enough to avoid being overtopped by winter flows; and anchored using pinning, cabling, and gluing techniques. The more obstruction a structure presented to the flow, the greater the induced scour. Riparian trees incorporated into structures to occupy interstices were useful. Finally, cable and threaded rebar were more aesthetically pleasing and safe when unobtrusive.

Past re-vegetation projects were labor intensive, and survival of alders on dry sites was poor. Planting sites near year-round water were more successful. Live siltation baffles made of willows were found to perform biological functions and, for a time, minor hydrological functions. However, observations of the live baffles were short term (two years).

Dynamics of Recovery concluded with a series of goals and recommendations for restoration of the Mattole Estuary. The two long-term goals for the Mattole Estuary were to reduce sediment entering the river, and to increase riparian cover from the mouth upstream to Honeydew. The four short-term goals were to increase pool depths, increase cold water available to juvenile salmonids, increase habitat complexity, and to increase cover. Recommendations were divided into three categories: those that relate to actions within the river channel in the lower river, those that would occur around the edges of the river, and those that would occur upstream and upslope. Recommendations are presented here verbatim from *Dynamics of Recovery* and are not necessarily endorsed by NCWAP or any of its member agencies:

Recommendations for Instream Actions:

1. Construct wing dams on Chambers Flat
2. Place woody debris masses in strategic locations throughout the lower river
3. Construct a scour and cover structure at Goff Point
4. Identify ways of reconnecting Bear Creek either to the mainstem Mattole River, or to its historic course in the south slough of the estuary
5. Continue the ban on fishing in the lowest mile of the river
6. Support the Mattole Salmon Group's rescue rearing program
7. Develop plans for controlled breaching of the lagoon to allow for smolt emigration
8. Monitor juvenile and adult salmonid populations
9. Monitor channel features in the lower river
10. Deepen our understanding of water temperatures
11. Enhance cold pools
12. Implement a basin-wide water conservation program including public education and a detailed evaluation of water use and appropriations

Near Stream Recommendations

General:

1. Increase biological complexity and activity throughout the riparian zone
2. Establish conditions to accelerate natural re-vegetation
3. Establish riparian cover and structure to produce lower water temperatures and improved aquatic habitat
4. Enhance stream bank stability

Specific:

1. Establish willows in areas adjacent to the low flow channel
2. Establish willows at the mouths of summertime cold water tributaries
3. Use live siltation baffles where appropriate
4. Use multi-species riparian forest restoration
5. Protect existing large woody debris
6. Protect the riparian zone from grazing
7. Encourage landowner protection of riparian forest
8. Establish a native plant nursery in the Mattole watershed
9. Continue to learn about riparian vegetation

Upstream and Upslope Recommendations

1. Plant riparian species along the mainstem from Honeydew down
2. Retain canopy over watercourses and adjacent zones
3. Acquire Mill Creek (R.M. 2.8) for conservation management
4. Inventory roads throughout the basin
5. Improve road maintenance
6. Update *Elements of Recovery* (1989 MRC inventory of the upslope sources of sedimentation in the Mattole Basin) with a focus on roads and quantification

7. Focus public attention on the health of the estuary/lagoon

Since 1995, when *Dynamics of Recovery* was published, local watershed groups and agencies have collaborated on several restoration projects aimed at improving the Mattole Estuary following the report's recommendations. The ban on fishing in the lowest mile of the river is still in effect, as is the Mattole Salmon Group's rescue rearing program. Monitoring of temperature, juvenile, and adults salmonids is also on-going. The Mattole Salmon Group has created a program encouraging water conservation throughout the basin, and the Mattole Restoration Council's Good Roads, Clear Creeks Program is aimed at road inventories and improving road maintenance. A 220-acre parcel of old growth forest in the Mill Creek (R.M. 2.8) watershed was acquired by the BLM in 1996 with the cooperation of the American Lands Conservancy and the Mill Creek Watershed Conservancy. In addition, the Mattole Restoration Council has initiated and is continuing to plan riparian planting programs throughout the basin.

Northern Subbasin

There are eleven perennial and intermittent fish bearing tributaries to the Mattole River in the Northern Subbasin (Table 27). There are many stream survey reports done by CDFG and BLM, Mattole Survey Program Annual Reports done by the Coastal Headwaters Association, and other documents concerning anadromous salmonid populations and habitat from various sources.

Table 27. Tributaries to the Northern Subbasin of Mattole River by River Mile from 7.5 minute topographic maps.

Tributary Name	Confluence (River Mile)	Length (Miles)	
		Permanent	Intermittent
Jim Goff Gulch	1.8		2.5
Jeffry Gulch	4.2		2.0
North Fork Mattole River	4.7	22.3	
East Branch North Fork Mattole River		8.0	
Alwardt Creek		3.2	
Rodgers Creek		1.4	
Sulphur Creek		2.5	
Unnamed Tributary #1 to Sulphur Creek		0.9	
Unnamed Tributary #2 to Sulphur Creek		1.3	
Mill Creek	5.5	2.7	0.6
Conklin Creek	7.8	3.0	
McGinnis Creek	8.0	5.0	
Thornton Creek	17.2	1.2	
Pritchett Creek	19.2	5.2	
Singley Creek	20.6	1.6	
Holman Creek	21.3		1.3
Upper North Fork Mattole River	25.5	4.7	
Rattlesnake Creek		4.8	
Oil Creek		4.6	
Green Ridge Creek		2.0	
Devils Creek		2.3	

Fourteen streams in the Northern Subbasin were surveyed by CDFG from 1960 to 1990 (Table 28). Out of thirteen streams surveyed in the 1960s, steelhead trout were found in eleven, coho salmon were found in two, and unidentified salmonids were found in one. High densities of steelhead trout were estimated for the East Branch of the North Fork Mattole River (500 per 100 feet of stream) and Mill Creek (R.M. 5.5) (300 per 100 feet of stream) in June 1966. Coho salmon were found in East Mill Creek (R.M. 5.5) and Devils Creek in the summer of 1966. Out of five streams surveyed in the 1980s, steelhead trout were found in two, rainbow trout were found in two, and unidentified salmonids were found in two.

Salmonid densities were estimated at 100 per 100 feet of stream in the East Branch of the North Fork Mattole River and McGinnis Creek in July 1982 and April 1985. Although 100 steelhead trout fingerlings were found per 100 feet of stream in an unnamed tributary to the East Branch of the North Fork Mattole River in June 1966, a CDFG stream survey in July 1982 described this small unnamed tributary as unsuitable for anadromous fish. Stream surveys of Sulphur Creek in July 1982 and September 1988 thought that it was probably not used by anadromous salmonids, but was used by resident trout. The BLM surveyed one stream, the North Fork Mattole River, in September 1977. Many juvenile steelhead trout were observed and salmonid habitat was described as being in good condition.

The results of surveys on six Northern Subbasin streams conducted by the Coastal Headwaters Association were summarized in the Mattole Survey Program Annual Report for the 1981-1982 salmon year. Steelhead trout were found in five streams. Interviews with local residents indicated that steelhead trout were found in all six streams and that historically, Chinook and/or coho salmon were found in five streams.

Other sources of information about anadromous salmonids in the Northern Subbasin included water diversion applications, letters, field notes, helicopter flight observations and a 1997-99 Redwood Sciences Laboratory study of juvenile coho salmon distributions in relation to water temperatures in the Mattole Basin (Welsh et al. 2001). Letters to the Humboldt County Department of Public Works in the 1960s revealed that a stream diversion program on the North Fork Mattole River was detrimental to steelhead trout. A snorkel survey of Sulphur Creek in September 1998 by the Natural Resources Management Corporation found steelhead trout, which contradicted the CDFG findings of no anadromous fish in 1980s stream surveys. A CDFG electrofishing survey of East Mill Creek (R.M. 5.5) in July 1975 found only 14 rainbow trout whereas the June 1966 survey had found coho salmon and high densities of steelhead trout. CDFG helicopter flight observations of McGinnis Creek and Pritchett Creek in March 1985 found several possible barriers to anadromous fish. A late 1990s Redwood Sciences Laboratory study of juvenile coho salmon distributions in the Mattole Basin sampled the Upper North Fork Mattole River and did not detect coho salmon.

Oil Creek, Rattlesnake Creek and Green Ridge Creek were sampled intensively by CDFG for their salmonid populations from 1991 through 1999 (Table 29). Preliminary data from this study were summarized in the CDFG administrative report *Stream Monitoring Progress Report for Five Small Streams in Northwestern California, Lawrence, Shaw, Oil, Rattlesnake, and Green Ridge Creeks 1991 through 1995* (Hopelain et al. 1997).

Green Ridge Creek steelhead trout abundance within a 65-foot sample reach during 1993-1995 ranged from 8 – 32 (Table 30). The number of age 1+ and older individuals averaged about two fish, ranging from zero to three. The monitoring reach was dry in 1992. Relative abundance expressed as fish per square-meter ranged from 0.18 to 1.88, and 0.0 to 0.07 for all age classes and age 1+ and older groups, respectively (Table 31).

Juvenile steelhead trout abundance within a 176-foot sample reach of Oil Creek ranged from 175 to 545 during 1992 – 1995 (Table 30). The number of age 1+ and older individuals averaged about 29 fish, ranging from nine to 54. Relative abundance of all steelhead age classes ranged from 0.49 to 1.52 fish per square-meter of stream surface (Table 31). Age 1+ and older individuals ranged from 0.03 to 0.15 fish per square-meter during this four-year reporting period.

Total juvenile steelhead trout abundance in Rattlesnake Creek declined from 302 in 1992 to 163 in 1994 (Table 30). Sampling was not attempted in 1995 due to warm water conditions.

Age 1+ and older individuals ranged from 17 to 48 during the three-year sampling period. Total fish per square-meter ranged from 0.76 to 1.41 (Table 31). Age 1+ and older individuals per square-meter ranged from 0.08 to 0.22.

Oil and Rattlesnake Creek total juvenile steelhead trout numbers were found to vary from year to year with no apparent trend. Although more steelhead trout were generally captured in Oil Creek, the four-year mean of 1.0 steelhead trout per square meter of stream surface was the same in each stream, ranging from 0.49 to 1.52 in Oil Creek and 0.76 to 1.41 in Rattlesnake Creek.

Table 28. Summary of available stream data in the Northern Subbasin other than 1990s CDFG stream surveys.

Comments are taken from the various data sources. 1990s CDFG Stream Surveys are summarized in the Condensed Tributary Reports Section of the CDFG Appendix.

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Jim Goff Gulch	CDFG Survey	6/21/1966	Almost dry on the date of the survey	A few steelhead fry observed	Only short stretches of spawning gravel available 1 mile upstream from mouth		No value for anadromous or resident fish
	Coastal Headwaters Association Survey	1981-1983	Dry to nearly a mile upstream; Severe erosion problems exist; Watershed damaged by logging and cattle grazing	Very few fish seen. Saw young-of-the-year and yearling steelhead trout; Historically, probably supported limited runs of steelhead trout and possibly coho salmon	Habitat conditions fair to poor		
Jeffry Gulch	CDFG Survey	6/21/1966	Lower half mile of stream dry	No fish of any kind observed; Local resident, TK Clark, had observed steelhead spawning near the bridge in past years	The lower part of the stream could be used by anadromous fish for spawning while water was flowing	11 log jams; No barriers	No management because of fast runoff
North Fork Mattole River	Water diversion application 15220	5/5/1953		Stream is used by anadromous fish for spawning purposes and as a nursery ground. There are trout located in the stream, and there is a good deal of summer trout fishing on it.			
	Letter from RJ O'Brien (CDFG Regional Manager, Region 1) to Charles Shaller (Director of Public Works, Humboldt County)	8/6/1965	In reference to a Corps of Engineers PL875 sponsored road protection project on the NF MR near Petrolia. It is our belief that channel relocation would have a harmful effect on the important salmon and steelhead trout resources. Large numbers of juvenile fish would be killed by such an operation. We recommend that the county delete or cancel its request.				
	CDFG Survey	8/419/66	Three large slides observed that come to the water's edge	Below the barrier approximately 25 steelhead trout, ranging from 1.5 to 4 inches in length per 100 ft of stream observed; Above the barrier, a few resident trout ranging from 1.5 to 12 inches found	Streambed infirst 7 miles composed of half good spawning gravel and half gravel silt and sand mixture; Pool: Riffle ratio 50:50	7 log jams; One barrier	Manage for anadromous fish

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
North Fork Mattole River (continued)	Letter from JS Day (CDFG Fisheries Biologist) to MR McFarland (Humboldt County Dept of Public Works Road Dept)	11/4/1966	We are opposed to continual diversion to protect the road bank. Re-channeling results in stranding young steelhead trout that are unable to migrate in the new channel. Also, dumping fill along the stream bank destroys pools that are holding significant numbers of young salmonids.				
	BLM Survey	9/4/1977	40 acre section owned by the BLM	Many juvenile steelhead trout observed and a few rainbow trout/steelhead trout sampled; Mr. Brashear, a local resident, has observed steelhead trout migrations up to a log jam in the BLM section; He has sighted many large steelhead trout in this section during spawning seasons	Areas of concentrated gravels which provide good spawning grounds for salmonids in the BLM section and above; Pool: Riffle ratio 1:1; Some pools with large quantities of fine materials on the bottom; 50% of section surveyed in pools and the cover in most pools is provided by large boulders, logs and some undercut bedrock formations	One barrier	A timber harvest sale of these 40 acres would be detrimental to the fishery of the Mattole River; Remove log jam observed
	Coastal Headwaters Association Survey	1981-1983	Largest tributary to the Mattole in terms of area; Only the lower 3 miles surveyed; Channel broad and severely aggraded	Moderate numbers of steelhead trout and possibly a few salmon reportedly use the North Fork for spawning, but claims need verification; Information obtained from several local residents indicates the possibility of a small population of summer steelhead trout; Historically, was a good producer of steelhead trout, but salmon not known to utilize drainage heavily	In-stream and near-stream habitat in extremely poor condition		
	CDFG Fisheries Management Field Note	9/2/1993		Sampled a 400 foot section of the NF Mattole River at T1S, R1W, Section 7 to determine if rainbow trout present were resident or anadromous. They were resident trout.			
East Branch North Fork Mattole River	CDFG Survey	6/22/1966		Approximately 500 steelhead trout fingerlings between 3/4 and 2 inches long per 100 ft of stream observed; Some yearling steelhead trout from 4 to 6 inches long observed; Approximately 20 resident trout about 1 foot long observed; A few of the fingerlings seined were determined to be resident trout	Approximately 3 miles of spawning gravel; Pool: Riffle ratio 60:40	17 log jams; One barrier	

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
East Branch North Fork Mattole River (continued)	CDFG Survey	7/1/1982		Two salmonid fingerlings approximately 2" in length seen in pool; Numerous salmonids seen 1.5 miles above the mouth; Estimated population 100 salmonids per 100 ft; Salmonids averaged 1inch long	Lower section a spawning/nursery area for anadromous salmonids. Substrate at the mouth estimated at 50% coarse gravel, gravel size more suitable for Chinook salmon spawning with the gravel being 20% embedded in the silt. In the upper section of the river (approximately 2.5 miles from the mouth) substrate estimated to be 90% gravel and 10% sand and silt with the gravel size suitable for steelhead and coho salmon spawning		
Unnamed Tributary to East Branch of North Fork of the Mattole River	CDFG Survey	6/22/1966		Steelhead trout fingerlings observed below the first barrier; There were about 100 per 100 ft of stream	Some spawning gravel in the lower 100 yards was found; In the upper part of the stream the water cascades from pool to pool while the lower part of the stream the Pool; Riffle ratio is about 3:1; Shelter and nursery areas are good in the first 100 yards but the upper part surveyed is rough boulders and fairly turbulent water flow.	One barrier about 70 yards from the mouth.	No clearance project can be recommended
	CDFG Survey	7/1/1982		Fish seen believed to be resident trout; Not suitable for anadromous fishes	Stream is adequate for anadromous spawning; Pool: Riffle ratio ranged from 2:1 to 1:3		Manage for resident trout
Sulphur Creek	CDFG Survey	7/1/1982		No anadromous fish believed to utilize this creek	The lower section, approxi mately a half mile, is potential spawning area for anadromous species; Pool: Riffle ratio averaged 1:2 with poor canopy shelter	Downstream barriers	Manage for rainbow trout
	CDFG Survey	9/1/1988		Rainbow trout the only fish observed	Spawning gravels were abundant throughout for resident trout; Gravels were loose and sized adequately	One barrier to anadromous salmonids and one barrier to resident trout but not steelhead trout	Take care when harvesting timber; Need adequate stream buffers; Address bank stability when planning harvests
	Natural Resources Management Corporation Snorkel Survey	9/2/1998		Steelhead trout the only fish species observed during the survey. Approximately 459 young-of-the-year, 214 age 1+, 44 age 2+ and 12 age 3+ juvenile steel head trout observed. Numbers equate to a minimum of 1,115 fish per mile. Appeared to be strictly a steelhead trout stream.			

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Mill Creek (R.M. 5.5))	CDFG Survey	6/23/1966	Most land in the drainage is pasture land	About 300 steelhead trout per 100 ft of streambed observed; Fish 1-2 inches in length with a few up to 6 inches; A few small coho salmon also observed	Streambed composed mostly of loose gravel; Pool: Riffle ratio 40:60; Many pools for nursery areas; Banks undercut in many places providing excellent shelter areas	One barrier on the East Fork	Manage for anadromous fish
	CDFG Electrofishing survey	7/13/1975	14 Rainbow trout caught				
	Coastal Headwaters Association Survey	1981-1983	Stream habitat conditions generally good except in areas impacted by livestock grazing; Stream sections where sheep and cattle excluded have good to excellent riparian cover and minimal erosion problems; However, areas where livestock have free access to the stream are moderately to heavily damaged	Steelhead tr out only fish observed; Historical information indicates stream once had good runs of steelhead trout, coho salmon, and probably Chinook salmon	Abundance of gravels, but spawning potential limited by extremely heavy siltation; Most riffles composed of gravel and rubble mixed with about 50% fine material; Pool bottoms generally covered with sand, silt and/or mud; Fair to good rearing habitat provided by instream woody debris and occasional undercut banks	7 stock fences observed - accumulating debris, which may occasionally impede adult fish passage	
Conklin Creek	CDFG Survey	8/2/1966	Logging is in progress now above the headwaters. The headwaters appeared to have been logged in the past	Large numbers of steelhead trout fry observed in the first two miles; Also some yearling steelhead trout	Entire main branch all spawning gravel, which contains silt and sand but is loose; Pool: Riffle ratio 1:3; 70% of the creek riffle area and pools small; Shelter appears poor	The Army Corps of Engineers cleared the main branch of debris recently	
	Coastal Headwaters Association Survey	1981-1983	Most of the watershed has been logged; In general, the watershed has recovered well except in the upper portions of the surveyed area where extensive revegetation opportunities exist	Juvenile steelhead trout common to abundant; Young-of-the-year steelhead trout predominant but yearling steelhead trout present in fair numbers; "Old-timers" state Conklin Creek once supported considerable runs of steelhead trout and some salmon	Channel in lower 1/4 of the stream exposed and aggraded; Provides essentially no suitable fish habitat; Upstream from this riparian canopy excellent and habitat conditions improve substantially; This section of the stream characterized by cascading, stair-stepping flow with many small pools and abundant instream cover; The few suitable spawning areas are distributed in patches among the dominant rubble/small boulder substrate	Few log jams; No barriers to anadromous salmonids	
McGinnis Creek	CDFG Survey	8/3/1966		Up to the impassable barrier, stream well utilized by steelhead trout; Resident rainbow trout from 2 to 8 inches observed above the barrier	Good spawning areas throughout; Mostly rubble and gravel, with some sand and silt in slower pools; Pool: Riffle ratio averaged 1:3; About 50% of the stream in the lower 2 miles was unshaded fast moving water, unsuitable for nursery areas	One barrier - a 20 ft waterfall	

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
McGinnis Creek (continued)	Coastal Headwaters Association Survey	1981-1983	Most of the watershed has been heavily logged; Heavily impacted by cattle grazing	Young-of-the-year steelhead trout extremely abundant; Few yearling fish observed; Long-time local residents report formerly supported good runs of steelhead trout and possibly some Chinook and coho salmon	Spawning size gravels fairly abundant but in general are moderately to heavily silted; Rearing habitat limited by shortage of instream cover		
	CDFG observations from Helicopter flight	3/1/1985				Good stream; Six or more jams in section 17; Recent logging in section 4; Looks like road access close to where jams are	
	CDFG Survey	4/23/1985	Judging from the amount of channel aggradation it seems likely that there are massive slope failures in the headwaters of McGinnis Creek	Young-of-the-year steelhead trout estimated at 100 per 100 ft of stream in the lower section of stream	Spawning habitat fair to good, gravels were well rounded, loose and moderately silty - appropriate for Chinook, coho and steelhead; Spawning habitat poor above 12,650 - gravels occurred in patches, were angular, heavily silted and partially compacted; Pool: Riffle ratio averaged 1:7 from the mouth to about 7,000 ft upstream, 1:2 or 3 from 6800 ft to 12,650 ft and 1:5 above 12,650 ft; Rearing habitat very poor from the mouth to about 7000 ft upstream - most pools lacked instream cover and overhead cover; Rearing habitat improved to good from 6,800 ft 12,650 ft - marked increase in woody debris and instream cover; Rearing habitat poor above 12,650 ft		Increase rearing habitat; Plant riparian vegetation; Consider fencing for livestock; Stabilize a slide; Modify a log jam; Leave the large log jam alone
Pritchett Creek	CDFG Survey	8/9/1966	First 1/4 mile of creek is dry each summer	Salmonid fingerlings observed in good numbers downstream from barrier; Upstream from barrier a few resident trout observed	First two miles excellent spawning gravel; Pool: Riffle ratio about 1:5; Very few pools present in most of the stream; No cover present for fish	17 log jams; One barrier - a 12 ft falls	Remove the one barrier presently in the stream
	CDFG observations from Helicopter flight	3/1/1985				Debris jams corner of 21,22,28,27 may not be barriers; Boulder roughs and debris in section 15	

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Pritchett Creek (continued)	CDFG Survey	4/5/1985		Four live steelhead trout, 4 redds and 1 salmonid skin observed	Spawning habitat poor - gravels angular, compacted in the lower and upper reaches and heavily silted; Pool: Riffle ratio averaged 1:15 in first 2800 ft, 1:8 from 2800-5200 ft, and 1:7 above 5200 ft; Rearing habitat was poor; Channel very aggraded with no well defined wetted stream channel for first 2800 ft		Low priority for stream rehabilitation; Lack of rearing habitat appeared to be the limiting factor
Upper North Fork Mattole River	CDFG Survey	8/25/1966		Fingerling and yearling young steelhead trout observed at about 150 fish per 100 ft of stream	Good spawning gravel along entire length; Only a few pools and undercut banks to provide shelter and nursery areas	No log jams	
	Coastal Headwaters Association Survey	1981-1983	Totally void of riparian vegetation in surveyed area	Steelhead trout fry identified through minnow trapping			
	Welsh et. al	2001	An MWAT of 70.7° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	No coho salmon found			
Oil Creek	CDFG Survey	8/16/1966		Steelhead trout from 2" to 8" observed at about 50 fish per 100 ft of stream	Approximately 2 miles of good loose spawning gravel; Substrate gravel and fine rubble with bedrock in some deep pools; Pool: Riffle ratio 2:1; Moderate amount of pools for shelter and nursery areas	3 log jams; No barriers	Manage for anadromous fish
Devils Creek	CDFG Survey	8/16/1966	Creek dry 3/4 mile upstream from mouth	About 15 fingerling steelhead trout and 5 fingerling coho salmon per 100 ft of streambed recorded; A few yearling fish seen in the larger pools	About 400 yards of good spawning gravel; Substrate mostly coarse rubble turning into bedrock in the upper 1/2 mile; Pool: Riffle ratio 1:1; Pools are shallow but offer some sheltered areas	One 4 ft high man made gravel dam 100 yards from the mouth	
Rattlesnake Creek	CDFG Survey	8/16/1966		Steelhead trout fingerlings (2") and yearlings (4-5") observed throughout the stream; A few 6" - 9" fish (steelhead trout) also observed	First mile all loose spawning gravel with some large boulders and bedrock forming deep pools; Pool: Riffle ratio 1:1; Shelter and nursery areas good due to deep pools with large boulders	29 log jams; 2 barriers	Remove all log jams; Manage for anadromous fish

Table 29. Reach length and habitat types within monitoring sections (Hopelain et al. 1997).

Stream	Length (ft)	Habitat Types*
Green Ridge Creek	65	GLD, SRN, MCP, LGR, RUN
Oil Creek	176	LGR, MCP, SRN, MCP, LGR, PLP
Rattlesnake Creek	176	RUN, MCP, RUN, LGR, MCP

*Habitat type codes: RUN = run, LGR = low gradient riffle, MCP = mid-channel pool, SRN = step run, GLD = glide, P LP = plunge pool.

Table 30. Summary of steelhead trout monitoring in Oil, Green Ridge, and Rattlesnake Creeks from 1992-1995 (Hopelain et al. 1997).

Stream	1992		1993		1994		1995	
	Population Estimate	Age 1+	Population Estimate	Age 1+	Population Estimate	Age 1+	Population Estimate	Age 1+
Oil Creek	304	35	175	9	454	54	545	17
Green Ridge Creek	NA*	NA*	82	0	8	3	42	2
Rattlesnake Creek	302	20	163	17	178	48	NA	NA

*NA = Not sampled.

Table 31. Estimated juvenile steelhead trout and age 1+ and older juvenile steelhead trout abundance expressed as fish per square-meter of wetted stream surface for Oil, Green Ridge, and Rattlesnake Creek (Hopelain et al. 1997).

Stream	1992		1993		1994		1995	
	All Age Classes	Age 1+ and Older	All Age Classes	Age 1+ and Older	All Age Classes	Age 1+ and Older	All Age Classes	Age 1+ and Older
Oil Creek	0.85	0.10	0.49	0.03	1.27	0.15	1.52	0.05
Green Ridge Creek	NA*	NA	1.88	0.0	0.18	0.07	0.96	0.05
Rattlesnake Creek	1.41	0.09	0.76	0.08	0.83	0.22	NA	NA

*NA = Not sampled.

Eastern Subbasin

There are 16 perennial and intermittent fish bearing tributaries to the Mattole River in the Eastern Subbasin (Table 32). There are many stream survey reports done by CDFG and BLM, Mattole Survey Program Annual Reports done by the Coastal Headwaters Association, and other documents concerning anadromous salmonid populations and habitat from various sources.

Table 32. Tributaries to the Eastern Subbasin of Mattole River by River Mile from 7.5 minute topographic maps.

Tributary Name	Confluence (River Mile)	Length (Miles)	
		Permanent	Intermittent
Dry Creek	30.4	4.4	
Middle Creek	31.3	3.3	
Westlund Creek	31.7	3.8	0.4
Gilham Creek	32.8	2.7	0.7
Duncan Creek	33.5		1.1
Fourmile Creek	34.6	3.9	
Sholes Creek	36.6	5.2	
Harrow Creek	38.2		2.3
Grindstone Creek	39.0	4.1	
Mattole Canyon Creek	41.1	6.7	0.6
Blue Slide Creek	42.0	8.2	
Fire Creek		2.3	
Box Canyon Creek	42.9	0.6	0.9
Deer Lick Creek	45.8	0.9	1.2
EubankCreek	47.7	3.3	0.7
Sinkyone Creek	52.0	1.1	0.4
McKee Creek	52.8	2.2	0.7
Painter Creek		1.8	

Fourteen streams in the Eastern Subbasin were surveyed by CDFG from 1960 to 1990 (Table 33). All fourteen streams were surveyed in the 1960s and steelhead trout were found in five, coho salmon were found in two, and unidentified salmonids were found in eight. Steelhead trout density in McKee Creek was estimated at 300 per 100 feet of stream in August 1966 and coho salmon were found in Westlund Creek and Harrow Creek in August 1965. Out of three streams surveyed in the 1980s, steelhead trout were found in one and unidentified salmonids were found in two. Although many salmonids were observed in Fourmile Creek in August 1965, a stream survey in October 1985 recommended that Fourmile Creek be considered a low priority for stream rehabilitation.

The BLM surveyed three streams in the Eastern Subbasin in 1977. An estimated 20 steelhead trout per 100 feet of stream were found in Dry Creek , while more than 100 steelhead trout per 100 feet of stream were found in Sholes Creek. The Sholes Creek report noted that this density of small fish found in the creek exceeded that of all the other tributaries to the Mattole River surveyed by BLM. Interestingly, in 1965 it was noted that Sholes Creek was severely impacted from logging abuse. No fish were observed in Gilham Creek in September in the BLM headwaters reach, which was dry at the time of the survey and not thought to contain suitable fish habitat. However, lower Gilham Creek was described by CDFG as having fish and habitat in 1965.

The results of surveys on eight Eastern Subbasin streams conducted by the Coastal Headwaters Association were summarized in the Mattole Survey Program Annual Report for the 1981-1982 salmon year. The results of surveys on Eubank Creek for the 1983-1984 year were in a later annual report prepared by the Coastal Headwaters Association. Steelhead trout were found five streams, coho salmon were found in two streams, and Chinook salmon or Chinook salmon redds were found in three streams during carcass surveys. Coho salmon were found in Eubank Creek, and McKee Creek while Chinook salmon were seen in Grindstone Creek, Mattole Canyon Creek, and Eubank Creek during carcass surveys. Interviews with local residents indicated that historically Deer Lick Creek was utilized by all three anadromous salmonid species and that Eubank Creek was considered the “finest” salmon stream in the area.

A 1995 Redwood Sciences Lab investigation found one coho salmon in Eubank Creek but none in an unnamed tributary between Little Finley Creek and Big Finley Creek.

Other sources of information about anadromous salmonids in the Eastern Subbasin included letters, field notes, helicopter flight observations, and a 1997-1999 Redwood Sciences Laboratory study of juvenile coho salmon distributions in relation to water temperatures in the Mattole Basin (Welsh et al. 2001). Letters to Judge Charles Thomas and Western Fisheries Management in 1965 concerning Sholes Creek indicate that about 1 mile of this stream was severely degraded by a logging operation. A letter to CDFG from Marylee Bytheriver in 1981 concerning Mattole Canyon Creek describes the stream as severely degraded by a logging operation. Helicopter flight observations of Westlund Creek, Sholes Creek, Grindstone Creek, and Blue Slide Creek in March 1985 found several possible barriers to anadromous fish. A late 1990s Redwood Sciences Laboratory study of juvenile coho salmon distributions in the Mattole Basin sampled Westlund Creek, Mattole Canyon Creek, Blue Slide Creek, and Eubank Creek and did not detect coho salmon.

Table 33. Summary of available stream data in the Eastern Subbasin other than 1990s CDFG stream surveys.

Comments are taken from the various data sources. 1990s CDFG Stream Surveys are summarized in the Condensed Tributary Reports Section of the CDFG Appendix.

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Dry Creek	CDFG Survey	8/3/1965	The winter storms of 1964-1965 deposited large quantities of gravel throughout the drainage; The high-water temperature may be a limiting factor for young salmonids during the latter portion of the summer	Several 1-4 inch salmonids observed throughout section surveyed	Suitable spawning gravel; Pool: Riffle ratio 1:3	Two log jams, both passable	Manage for anadromous fish; Do not remove log jams
	BLM Survey	10/11/1977	Most of the BLM section goes dry in late summer; Sediments may be the limiting factor for egg and fry survival; Local residents blame the 1964 flood for reduced numbers of fish in the creek	A few 6" rainbow trout/steelhead trout sampled in and below BLM section; Number of fish estimated as less than 20 per 100 ft of stream; No young-of-the-year fish observed; One local resident saw a 2-3 inch fish in the spring of the year	Good spawning grounds in the BLM section; Pool: Riffle ratio ranges from 1:8 to 1:3; Lack of summer flows and pools make poor salmonid rearing grounds in BLM section; Areas downstream better rearing grounds		Manage for anadromous fish; It may be quite a while before this stream returns to its original state
	Coastal Headwaters Association Survey	1981-1983	Numerous landslides; impacted by logging and roads	Young of the year salmonids, probably steelhead trout, observed in upper portions of creek in the spring	Gravels deposited in the middle section, before the stream plunges down its canyon to the Mattole		
Middle Creek	Letter from Richard Wood, Associate Fishery Biologist, to Robert McGuiness about the possibility of stocking fish in Middle Creek	3/4/1958		No native stocks available for planting in the Mattole drainage; Records indicate that Middle Creek is primarily a steelhead trout stream and probably has a sufficient number of adults returning to the stream to maintain the population; Chinook and coho salmon have also used the creek but both stocks are depressed at this time, therefore few have probably been seen lately			
	CDFG Survey	8/3/1965		Salmonids ranging from 2 to 6 inches in length were abundant for the first 700 yards; Upstream from this point, fewer fish were observed	Spawning areas moderate in occurrence; Pool: Riffle ratio 1:1; Shelter plentiful in the form of logs and boulders in the streambed	Log jams and debris numerous; No barriers; 5 ft waterfall 700 yards upstream	
Westlund Creek	CDFG Survey	1963	Most of the drainage, logged over; Stream banks very steep and pose a serious erosion problem along the entire area surveyed, including unlogged areas; Because of this, a lot of silt and sand have been deposited in the creek compacting the gravel somewhat in the headwater regions	Several salmonids, about 5 inches in length, observed in the main stream channel but not in the tributaries	Spawning conditions mediocre; In the main stream channel more riffles but the streambed has larger and more unfavorable size rocks; Shelter very good because of large rocks, boulders, logs and a variety of pools	Many log jams; Some causing small waterfalls that could be barriers	
	CDFG Survey	8/3/1965		Many salmonids seen; From the mouth to about 1/4 mile upstream, salmonids primarily coho salmon fry ranging in size from 1-21/2 inches; In the upper section surveyed fish seen steelhead trout fry ranging in size from 1 to 3 inches	Spawning conditions excellent; No pools from mouth until 1 1/2 miles upstream; In upstream areas Pool: Riffle ratio 2:1; Most shelter areas created by boulders and large rocks in riffle areas	2 log jams; No barriers; approximately 1 3/4 miles upstream from mouth, streambed choked with blown down timber and earth slides for about 1/4 mile	Manage for anadromous fish; Clear debris jam to open 2 miles of additional spawning

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Westlund Creek (continued)	CDFG observations from Helicopter flight	3/1/1985	Lower section aggraded; Upper steep gradient with good riparian cover; Road along creek				
	Welsh et. al 2001	2001	An MWAT of 63.5° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	No coho salmon found			
Gilham Creek	CDFG Survey	8/3/1965	The streambed appeared to be scoured out by the flood of December 1964; In some areas, the streambed lowered as much as 10 ft	Young salmonids 2-3 inches in length common in the first 3/4 of a mile; The last 1/4 mile of the surveyed area had fewer salmonids	Good spawning areas available; Pool: Riffle ratio estimated at 1:1; Shelter areas consisting mostly of undercuts around rocks and small boulders common	3 log jams; No barriers	
	BLM Survey	9/7/1977	Surveyed BLM headwaters section; Headwaters dry at the time of the survey	No fish observed	The BLM headwaters of Gilham Creek offer no suitable habitat for any type of a fishery due to typical headwaters characteristics		
	Preharvest inspection of a timber harvest conducted by John E. Hummel, Wildlife Biologist	1/3/1980		Observed salmonid species of three different ages classes; Fish not identified to species, however, parr marks were distinct and rectangular	Riffles and pools frequent	Debris from logging operations created barriers in various locations	
Duncan Creek	CDFG Survey	8/4/1965		Numerous small salmonids sighted; Size averaged 1-2 inches in length	Spawning areas primarily restricted to first 1/4 mile above mouth; Pool: Riffle ratio approximately 3:1 for first mile of above mouth, 1:1 further upstream; Shelter areas moderate in occurrence and created by pools, boulders, and the current action of the stream	1 log jam; No barriers	
Fourmile Creek	CDFG Survey	8/4/1965	Winter flood of 1964 scoured the channel	Many salmonids observed in the riffles; Fish ranged in size from 2-5 inches	Many ideal spawning sites seen all along the creek; Pool: Riffle ratio about 1:5; No overhanging vegetation to provide brood shelter but fingerling fish thriving in the riffles	1 debris jam 1 1/2 miles upstream from the mouth; No barriers; 250 yard stretch dry creek bed 1 1/4 mile upstream from mouth	Manage for anadromous fish; Stream clearance not necessary
	CDFG Survey	1/10/1985		Two redds in the lower section; Two juvenile steelhead observed in an unnamed tributary	Spawning habitat marginal to fair - gravels angular with rounded edges, silted and somewhat compacted for 1 mile above the mouth; Spawning habitats limited - gravels present were angular and silted from 1 mile above the mouth to 3 miles above the mouth; Pool: Riffle ratio averaged 1:7 for lower stretch and 1:15 for the upper stretch; Rearing habitat limited with only a few large pools with little protection	4 obstructions; 2 possible barriers	Low priority for rehabilitation work

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Sholes Creek	CDFG Survey	8/5/1965	Appeared to have been logged in last 15 years	Numerous salmonids sighted; Their sizes were mostly in the 1-2 inch class	Exceptionally good spawning area for anadromous fish; Pool: Riffle ratio 1:3; Suitable habitat for rearing young steelhead trout and salmon	1 log jam; No barriers	
	Letter to Judge Charles Thomas from CDFG RJ O'Brien, Regional Manager, Region 1 about logging damage to Sholes Creek	9/23/1965	Sholes Creek, in the logged area, has had its fish habitat completely destroyed by Mr. Green's logging operation; Salmonid fishes cannot maintain a healthy population in a habitat that is made up of polluted water, logging roads, log landings, skid roads, and excessive siltation; The losses resulting from this operation are irrevocable				
	Letter to Western Fisheries Management from John S. Day, Fishery Biologist II about logging damage to Sholes Creek	11/10/1965	Warden Robert Perkins of Garberville stated that the logging damage to Sholes Creek was the most severe he had ever witnessed; This is a significant statement since Warden Perkins has observed North Coast Logging operations since 1945; Approximately 1 mile of stream was damaged				
	BLM Survey	8/4/1977	The numbers of small fish found in this stream exceeds any of the other tributaries to the Mattole River surveyed	Steelhead trout to 6 inches observed in the BLM section, but fish of this size were rare; Steelhead trout to 2 inches were found in quantities of up to 100+ per 100 ft of stream	Much of the good gravels concentrated into areas making excellent spawning grounds; Pool: Riffle ratio estimated at 1:5; Adequate rearing grounds	A few log jams; No barriers	Should remain a naturally propagating anadromous tributary to the Mattole River
	CDFG observations from Helicopter flight	3/1/1985	Wide aggraded streambed in lower section; 5 log jams beginning where stream turns east west				
Harrow Creek	Dissolved Oxygen determinations by John S. Day, Fisheries Biologist II	8/3/1965	All samples taken on 7/29/1965; Water temperature at four stations 59 degrees; Station 1 approximately 100 yards downstream from the junction point of the logging spur road with its branches, DO 2.0 ppm; Station 2 approximately 200 yards downstream from the junction point of the logging spur road with its branches, DO 4.8 ppm; Station 3 approximately 300 yards downstream from the junction of the logging spur road with its branches, DO 2.4 ppm; Station 4 approximately 150 yards upstream from the junction point of the logging spur road with its branches, DO 0.6 ppm				

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Harrow Creek (continued)	CDFG Survey	8/5/1965		Several coho salmon fingerlings were seen near the mouth of Harrow Creek; Many steelhead trout fry seen in the surveyed portion of the stream below a 30 ft rock falls; No salmonids seen in the stream above this falls	Most spawning areas heavily silted in; Pool: Riffle ratio 1:1; Most of the shelter for juvenile fishes provided by boulders and rock overhang; Little overhanging vegetation along the creek	4 log jams; 30 ft impassable falls	The gorge above the falls too sheer and narrow to merit blasting out; Clear jams below the falls to make about 1/4 mile of stream available to spawning fish
Grindstone Creek	CDFG Survey	8/5/1965		Salmonids ranging from 1 to 4 inches in length observed in moderate abundance	Very little spawning area observed; Only spawning area at the tail end of pools; Pool: Riffle ratio 1:2 in the all but the first 1/4 mile of stream which was completely devoid of pools; Shelter afforded by logs located in the streambed; No shelter afforded to fish by lower story vegetation	Frequent log jams	
	Coastal Headwaters Association Survey	1981-1983	Watershed heavily logged and roaded in last 30 years	Still supports a remnant run of Chinook salmon - three pair of adult Chinook salmon observed	Spawning habitat available to salmon and steelhead trout extends about 1/4 mile upstream from the mouth to the first major log jam; Rearing habitat for Chinook salmon fry and steelhead trout available from the mouth to 3 miles upstream; Fish habitat has been destroyed in many ways	Severe fish passage problems - only the lower 1/4 mile accessible to anadromous salmonids; Numerous log jams and landslides	1. Do not pull out log jams; 2. Revegetate areas of stored sediment behind jams and slide areas adjacent to streams; 3. Set up a hatch box for Chinooksalmon and steelhead trout about 3 miles upstream from the mouth of the creek
	CDFG observations from Helicopter flight	3/1/1985				Didn't see any debris that looked like barriers; several slides	
Mattole Canyon Creek	CDFG Survey	8/24/1966	Watershed mainly logged dry coniferous forest; Some virgin timber stands still present in the headwaters but presently being logged; A road plowed in the stream bed that appears to be maintained from year to year	Salmonid fingerlings observed throughout the section surveyed; The lower section had notably fewer fingerlings than where pools and cover still intact; Steelhead trout young from 2-8 inches observed	Very good spawning gravel; No pools in lower section and a Pool: Riffle ratio of 3:1 in upper section; Shelter and nursery areas only in upper two miles	20 log jams; No barriers except in the headwaters	The section of stream from the mouth upstream about 4.5 miles has heavy deposits of gravel and the stream does not appear to be digging its way down to its original channel; The stream flows down the plowed roadway several places and spreads out in others; Channelization may be necessary in this section to make the stream stay in one place

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Mattole Canyon Creek (continued)	Letter to Mr Naylor, Department of Fish and Game, from Marylee Bytheriver concerning recent activities in Mattole Canyon Creek	7/17/1981	Summary of recent events affecting Mattole Canyon Creek: 1. Warden Lou Barnes gives permission for bulldozing a road up the creek bed that crosses flowing water 20 times in 1 1/2 miles; 2. Warden Barnes receives complaints about said road; 3. Warden Barnes directs a CCC crew to remove the fish from the pools of the creek and dump them into the Mattole River; Mattole Canyon Creek severely disturbed by poor logging practices about 20 years ago, however, the creek has begun to restore itself; With a return of riparian vegetation has come a return of steelhead trout and Chinook salmon				
	Coastal Headwaters Association Survey	1981-1983	80% of watershed logged and roaded in the last 20 years; A ten acre landslide reactivated during heavy storms of December 15-19 1981, providing enough bedload sediment to the upper half of the watershed to fill all pools and cause extensive channel migration	7 spawning pairs of Chinook salmon observed in December 1981 but redds destroyed by channel migration; fry counts in spring 1982 indicate that 90-95% of populations were displaced or wiped out by a landslide; Observations and minnow trapping throughout the spring of 1982 show severely reduced salmonid populations (fry and juveniles) compared to numbers present in past years; No fish observed during the last two weeks of December 1981 and early January 1982	Fish habitat has been diminished and destroyed by landslide debris, loss of riparian vegetation, filling of channel and pools	Many landslides, many man-made watercourses	Outlook for rehabilitation of this watershed is poor. Recommendations: 1. Revegetate landslide slopes and riparian areas; 2. Install a hatchbox for Chinook salmon; 3. Delta area of watershed might be nudged towards channelization using disconnected wingwalls; 4. An erosion control manual should be prepared for property owners
	Welsh et. al 2001	2001	An MWAT of 72.5° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	No coho salmon found			
Blue Slide Creek	CDFG Survey	8/24/1966	Land surrounding the upper sections of the creek being logged	Steelhead trout from 2-6 inches in length observed at about 20 fish per 100 ft of stream; Most abundant in areas which hadn't been logged recently	Gravel more abundant at mouth; Only limited shelter and nursery areas because many pools have been filled with dirt and slash	7 major log jams; all barriers; 10 road crossings; 6 partial and 1 a complete barrier - 15 ft high and 15 ft wide with no culvert	Because of recent logging, Blue Slide Creek is in very poor condition, especially in the upper sections; Remove the 15 ft road crossing near the mouth or install a culvert; Remove log jams
	CDFG observations from Helicopter flight	3/1/1985				Possible low water boulder barrier in section 9 close to road; 12 ft falls just above upper right hand fork; Good stream above with road access	
	Field notes by Preston, Vorpagel, Jong, Long	5/3/2000	Conductivity = 135.8 µS; Water temperature 12.4 degree Celsius				

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Blue Slide Creek (continued)	Welsh et. al 2001	2001	An MWAT of 70.7° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	No coho salmon found			
Deer Lick Creek	Coastal Headwaters Association Survey	1981-1983	Erosion and debris problems evident; Permissions for surveys have yet to be received	According to Joe Wolf, a long term resident of the area, this creek at one time supported all three anadromous salmonid species			
Unnamed Tributary between Little and Big Finley Creeks	Redwood Sciences Lab sampling	8/4/1995		0 coho salmon caught			
	Redwood Sciences Lab sampling	9/22/1995		0 coho salmon caught			
EubankCreek	CDFG Survey	9/7/1966	Dry for 95% of length	A few salmonids seen in pools, but no estimate made because of the lack of water in the creek	Good spawning gravel throughout the section surveyed; Pool: Riffle ratio 1:1	14 log jams; 1 road crossing	Remove log jams and road crossing; Manage for anadromous fish
	Coastal Headwaters Association Survey	1981-1983	Lower watershed heavily damaged by logging, roads and fire	Substantial numbers of young-of-the-year coho salmon and steelhead trout found in the lower reach; Steelhead trout found above and below the jam; Historical indications are that the stream was a heavy salmon producer; Harold McKee, a man in his 80s who was born and raised in this area, told us that this creek formerly was the finest salmon stream in the area	Middle reach has some spawning gravels and good rearing habitat	Three debris jams; one 0.7 miles above mouth a barrier to anadromous salmonids	Remove or modify two debris jams in the lower reach; Replant the lower reach riparian zone
	Coastal Headwaters Association Survey	1981-1983	Lower watershed heavily damaged by logging, roads and fire	Substantial numbers of young-of-the-year coho salmon and steelhead trout found in the lower reach; Chinook salmon redds reported above modified jam	Middle reach has some spawning gravels and very good rearing habitat; Upper reach shows severe siltation and compaction of the aggraded gravel beds	Three debris jams, one 0.7 miles above mouth a barrier to anadromous salmonids but removed by a CCC crew in 1983	Replant lower reach riparian zone and contiguous slopes; Also siltation of upper reach beds should be reduced by removal of some old jams and logs
	Redwood Sciences Lab sampling	8/18/1995		1 coho salmon caught			
	Redwood Sciences Lab sampling	8/16/1995		0 coho salmon caught			
	Redwood Sciences Lab sampling	8/17/1995		0 coho salmon caught			
	Redwood Sciences Lab sampling	9/27/1995		0 coho salmon caught			

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
EubankCreek (continued)	Memorandum to Glen J Newman, CDF, from CDFG Region 1 about a Focused Preharvest Inspection for Nonindustrial Timber Harvest Management Plan	11/9/1998		A 1994 Study by Dr. Bret Harvey from the Redwood Sciences Laboratory and Maureen Roche of the Mattole Salmon Group confirmed presence of high densities of young-of-the-year steelhead trout but few yearling steelhead trout; One young-of-the-year coho salmon was also captured; Contemporary populations of steelhead trout are known by CDFG to occur in Eubank Creek; The Mattole Salmon Group identifies the creek as a contemporary steelhead trout, coho salmon and Chinook salmon stream; Risk assessment of logging to creek			
	Welsh et. al 2001	2001	An MWAT of 62.6° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	No coho salmon found			
Sinkyone Creek	Coastal Headwaters Association Survey	1981-1983	Oldest known site of human habitation in northern coastal California; An earthen dam in the watershed burst in 1976 sending a wall of water down the entire length of the mainstem; Burst dam has since been bulldozed back in	Minnow trapping and visual surveys showed the first reach to contain steelhead trout; Reaches above first waterfall barren of fish	Fair to good habitat before first waterfall; Short stretch from mouth to culvert has compacted cobbles and fresh siltation covering the bottom every summer; extensive good habitat above waterfall	Culvert with 4 ft drop; 6 ft bedrock waterfall that appears to function as a fish barrier; Diversion dams in higher reaches	Recommend a passage for the waterfall be devised
McKee Creek	CDFG Survey	8/18/1966		Many steelhead trout observed; Two 6 inch rainbow trout sighted; Steelhead trout fry observed and estimated to be about 300 per 100 ft of stream where maximum flows were found	Entire bed made of excellent spawning gravel; Pool: Riffle ratio 3:1; Shelter and nursery areas very good	21 log jams, 1 complete barrier; 1 culvert	
	Coastal Headwaters Association Survey	1981-1983	Upper half and more of McKee Creek extensively logged in the past	Juvenile coho salmon and juvenile steelhead trout identified by electrofishing in the lower section during the fall of 1982; A few apparent salmon redds seen near mouth during high water surveys; Chinook salmon spawning suspected but has yet to be verified	Gravels are extensive but mostly small in size, excessively sandy, and somewhat compacted; Suitable spawning habitat for steelhead trout and coho salmon extends virtually to the headwaters	4 ft culvert on the county road; Few debris jams, one a possible barrier to anadromous salmonids	Instream habitat improvement work warranted
	CDFG Survey	1/25/1985		Several juvenile salmonids approximately 1 1/2 inches in length seen	Spawning habitat for Chinook salmon fair in the lower section and marginal in the upper section; Rearing habitat good and provided by boulders and undercut bedrock in the lower section and woody debris in the upper section	Several debris jams; three barriers	Modify barriers; Stabilize banks; Manage for anadromous fish
Painter Creek	CDFG Survey	8/18/1966	Almost completely dry at the time of the survey	No fry in pools above the highway crossing	Good spawning gravel	7 x 7 concrete culvert with a 5 ft falls at the lower end which might be a possible barrier	No management necessary

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Painter Creek (continued)	Coastal Headwaters Association Survey	1981-1983		Steelhead trout abundant above the bridge	Extensive cobble substrates set with sand or fine gravel alternating with bedrock outcrops	One possibl e barrier to anadromous salmonids - a concrete bridge at the county road, 7 ft high by 9 ft high and 65 ft long, 5 ft downstream drop	Modification of bridge to facilitate salmon passage priority treatment recommended for Painter Creek to open over 1 mile of Chinook and coho salmon spawning habitat; Recommend that Painter Creek is a premier choice for Chinook salmon hatchling release
	Painter Creek Culvert Improvement Project Final Report	9/1984				Fish passage blockage at the Painter Creek culvert repaired by constructing a boulder weir (to raise tail water levels) and installing a concrete separator wall (to channel and deepen flows inside the culvert); Additional work done to remove an interfering protrusion of bedrock and to armor and stabilize a rapidly eroding stream bank at the upstream end of the culvert; These improvements have put back into production over one mile of stream for native salmon spawning and rearing	
	CDFG Survey	1/25/1985		Three juvenile salmonids seen	Spawning habitat fair-poor for steelhead trout and possibly coho salmon, but not adequate for Chinook salmon; Rearing habitat good, provided by boulders and woody debris	Concrete culvert 10 ft x 10ft x 20 ft under Shelter Cove Road with a 5 ft drop	Possibly modify culvert to allow easier passage; Manage for steelhead trout and resident trout

Southern Subbasin

There are 19 perennial and intermittent fish bearing tributaries to the Mattole River in the Southern Subbasin (Table 34). There are many documents concerning these streams, including stream survey reports by CDFG and BLM, Mattole Survey Program Annual Reports by the Coastal Headwaters Association, and other documents concerning anadromous salmonid populations and habitat from various sources.

Table 34. Tributaries to the Southern Subbasin of Mattole River by River Mile from 7.5 minute topographic maps.

Tributary Name	Confluence (River Mile)	Length (Miles)	
		Permanent	Intermittent
Bridge Creek	52.1	3.3	0.5
West Fork of Bridge Creek (Robinson Creek)		1.7	0.5
South Branch of the West Fork of Bridge Creek		1.2	0.5
Vanauken Creek	54.0	1.9	0.4
South Fork Vanauken Creek		0.8	
Anderson Creek	55.6	1.3	
Ravasoni Creek	55.6	1.5	
Mill Creek	56.2	2.4	0.5
Harris Creek	56.5	1.6	0.5
Gibson Creek	56.8	1.2	0.4
Stanley Creek	57.1	1.2	0.9
Baker Creek	57.6	2.3	
Thompson Creek	58.4	3.1	0.6
Yew Creek			1.4
Helen Barnum Creek	58.7		1.2
Lost Man Creek	58.8	1.5	
Unnamed Tributary to Lost Man Creek			0.8
Big Alder Creek	59.5		0.4
Pipe Creek	59.8		0.3
Dream Stream	60.0		0.4
Arcanum Creek	60.1		0.5
Big Jackson Creek	60.2		0.6
Phillips Creek	60.4		0.4
McNasty Creek	60.8		0.8
Ancestor Creek			0.6

Eight streams in the Southern Subbasin were surveyed by CDFG from 1960 to 1990 (Table 35). Out of seven streams surveyed in the 1960s, steelhead trout were found in five, coho salmon were found in one, and unidentified salmonids were found in two. Steelhead trout density in Baker Creek was estimated at 100 per 100 feet of stream and coho salmon were found in Mill Creek (R.M. 56.2) in August 1966. Bridge Creek was surveyed in 1971 and 88 steelhead trout/rainbow trout were captured. Out of four streams surveyed in the 1980s, steelhead trout were found in three, rainbow trout were found in two, and unidentified salmonids were found in one. Steelhead trout density in Baker Creek was estimated at 30-40 per 100 feet of stream in November 1982.

The BLM surveyed three streams in the Southern Subbasin in 1972 and 1977. More than 50 salmonids per 100 feet of stream were estimated in Bridge Creek in July 1972, while only a "few" juvenile steelhead or small salmonids were estimated in Anderson Creek and Baker Creek in July 1977.

The results of surveys on nine Southern Subbasin streams conducted by the Coastal Headwaters Association were summarized in the Mattole Survey Program Annual Report for the 1981-1982 salmon year. Steelhead trout were found in seven streams, Chinook salmon were found in one stream, and coho salmon were found in four streams. Chinook salmon were seen in Bridge Creek in December 1981while coho salmon were found in Upper Mill Creek (R.M. 56.2) in 1982, Stanley Creek in the spring of 1982, Baker Creek, and Thompson Creek in September 1981. Interviews with local residents indicated that historically Baker Creek was important for salmonids.

A 1995 Redwood Sciences Lab investigation found 16 coho salmon in Yew Creek in September and October but none in Ancestor Creek in August and October.

CDFG electrofishing surveys conducted in the Southern Subbasin found steelhead trout in 10 streams and coho salmon in 6 streams. Coho salmon were found in Baker Creek in July 1993, July 1995, and July 1998. Coho salmon were also found in Thompson Creek in August 1986, July 1994, July 1995, July 1996, September 1998, August 1999, and September 1999; the South Branch of Thompson Creek in August 1986; Yew Creek in September 1995; the headwaters of the Mattole River in August 1986; and McNasty Creek in August 1986.

Other sources of information about anadromous salmonids in the Southern Subbasin included other stream surveys, CCC Work Plans, CDFG letters, field notes, a CDFG Sediment and Bottom Invertebrate Sample Results Report, and a 1997-1999 Redwood Sciences Laboratory study of juvenile coho salmon distributions in relation to water temperatures in the Mattole Basin (Welsh et al. 2001). A CDFG salmon spawning stock survey in January 1990 on Bridge Creek found no live fish, carcasses, or redds. CCC Work plans showed that salmonid habitat restoration was completed on the South Fork of Bridge Creek (Robinson Creek), Vanauken Creek, Stanley Creek, and Baker Creek. A stream survey done as a part of the work plan on Vanauken Creek found coho salmon below the Whitethorn Road culvert. A 1990 letter from CDFG to the Wildlife Conservation Board recommends that Gibson Creek not be considered for stream restoration work due to poor water quantity and quality for anadromous salmonids. Later, a memorandum from CDFG to CDF in 2001 indicates that CDFG considers that stream restorable habitat and is therefore a class one stream.

CDFG Field Notes indicate that redds were found in December 1994 and January 1995 on Baker Creek but not found in January 1995 in Vanauken Creek. Field notes also indicated that habitat manipulation for pools might be necessary on Vanauken Creek to facilitate steelhead trout and coho salmon production; and that a culvert on Gibson Creek might impede salmonid movement. An analysis of sediment samples and bottom invertebrate samples collected by CDFG in Baker Creek in June 1980 was also conducted. Sample results for substrate composition and invertebrate results for pool areas indicate that sediment had been delivered into Baker Creek in quantities deleterious to fish life. A Redwood Sciences Laboratory study of juvenile coho salmon distributions in the Mattole Basin sampled Vanauken Creek, Baker Creek, Lost Man Creek, the headwaters of the Mattole River, Yew Creek, Thompson Creek, and Bridge Creek. Coho salmon were detected in Baker Creek, Lost Man Creek, the headwaters of the Mattole River, Yew Creek, Thompson Creek, and Bridge Creek.

Table 35. Summary of available stream data in the Southern Subbasin other than 1990s CDFG stream surveys.

Comments are taken from the various data sources. 1990s CDFG Stream Surveys are summarized in the Condensed Tributary Reports Section of the CDFG Appendix.

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Bridge Creek	CDFG Survey	6/29/1971	Electrofishing survey in response to Mr. Stevenson's, a local resident, observation of a brown trout and questions about crayfish	88 steelhead trout/rainbow ranging from 1.3 to 6.5 inches trout captured	Good nursery stream for steelhead trout	1 Log jam; Not currently a barrier but could become one	Remove log jam; Do further sampling in the fall to determine if brown trout are present
	BLM Survey	7/17/1972	Area recovering from logging over 10 years ago; Several homes along the lower section draw water from the stream for house use and/or for irrigation purposes; The withdrawal is not major and constitutes no kind of threat at this time	Salmonids, 2-10 inches in length abundant (50+ per 100 ft of stream)	Excellent spawning grounds from the mouth to the junction with Robertson Creek, 1 1/2 miles upstream; Pool: Riffle ratio 1:4; Shelter provided by large boulders, deep pools, cut banks and logs	Several debris jams; One area of dry creek bed for 40 yards; 1 temporary swimming dam	Manage for anadromous fish; Stream looks to be a very big producer of steelhead and salmon

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Bridge Creek (continued)	CDFG Survey	7/21/1980	Purpose of survey to examine possible anadromous fish barriers; Electrofishing used	All fish collected were steelhead trout/rainbow trout; 51 trout collected; Only rainbow trout found above the barriers	Substrate 20% gravels; Pool: Riffle ratio averaged 1:10	2 barriers	Remove both barriers to facilitate usage of upstream anadromous fish habitat
	Coastal Headwaters Association Survey	1981-1983	Upper watershed severely impacted by 1973 fire	Juvenile steelhead trout observed in the early fall 1981; Chinook salmon seen spawning in lower section from 1 to 22 December 1981; Adult salmon seen up to 3 January 1982; Nearly all seen were Chinook salmon, although steelhead trout and possibly coho salmon also present during this time	Fair to excellent spawning conditions in the lower section, though gravels silted towards the mouth; Predominantly larger gravel sizes that tend to favor Chinook salmon	CCC has modified several barriers on Bridge Creek	A top priority for improvement
	CDFG electrofishing	9/11/1989		36 steelhead trout caught in a 60 ft reach			
	CDFG Salmon Spawning Stock Survey	1/10/1990		No live fish, carcasses, or skeletons found; No redds observed			
	CDFG electrofishing	7/13/1993		26 steelhead trout caught in a 150 ft reach			
	Welsh et. al 2001	2001	An MWAT of 60.8° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	Coho salmon found			
South Fork of Bridge Creek (Robinson Creek)	Stream Enhancement Work Plan	3/8/1988	The first 3600 ft of SF Bridge Creek excellent salmonid habitat and some potential for improvement; All indications are that SF Bridge Creek is a viable salmonid stream	One pair of steelhead trout observed spawning at 2690 ft, which is above all of the surveyed debris accumulations; Young-of-the-year fish, presumed to be salmonids, spotted at two locations in the stream above the debris accumulations		All of the debris piles encountered determined not to be barriers to salmon migrations, though this condition should be monitored	It is recommended that the three projects in this report be executed during the spring and summer months
Vanauken Creek	CDFG Survey	1966		Steelhead trout fingerlings and a few 4-5 inch yearlings observed throughout the area surveyed, except above the 12 ft falls	Numerous small beds of loose spawning gravel; Pool: Riffle Ratio 3:1; Shelter and nursery areas good due to pools, steep banks and overhanging logs	30 log jams, No barriers; 1 12 ft rock falls a barrier to anadromous fish	Remove all log jams; Manage for anadromous fish
	Coastal Headwaters Association Survey	1981-1983	Not yet surveyed	Known to be an important steelhead trout and salmon stream		Debris problems known to exist	
	CDFG Survey	9/27/1982		Numerous steelhead trout fry, 50 per 100 ft of stream, 2-3 inches long; Few 1+ fish seen	Spawning gravel suitable for Chinook salmon, coho salmon and steelhead trout abundant; Gravel somewhat silted but un-compacted; Pool: Riffle ratio averaged 1:5; Rearing habitat limited	Several debris jams; Five possible barriers	Alter all mainstem jams mentioned to allow better fish passage and in some cases to reduce stream bank erosion

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Vanauken Creek (continued)	CCC Work Plan	5/20/1988	Work plan for the improvement of access for salmonids through the culvert	Electrofishing found steelhead/rainbow trout above and below the culvert: 7 young-of-the-year, and 7 age 1+ above the culvert; 73 young-of-the-year and 6 1+ steelhead/rainbow trout found along with 14 young-of-the-year coho salmon below the culvert	Vanauken Creek provides good spawning and rearing habitat for anadromous salmonids; Bottom composition averaged 5% bedrock, 35% boulder, 30% gravel, 15% fines; Canopy above the culvert ranged from 50-90%; Steep canyon walls with riparian vegetation formed 90% canopy downstream of the culvert		
	CDFG Field Note	8/3/1989	Road culvert modification conducted by the CCC in 1988 to allow fish passage upstream;	Many steelhead trout young-of-the-year observed in a spot check of a 500 ft stream section above the road culvert; Coho salmon absent despite adequate water temperature and pools with cover structure			Recommend habitat manipulation for pools with woody debris cover to facilitate both coho salmon and steelhead trout juvenile production
	CDFG Field Note	1/4/1995		No live fish or carcasses observed; One possible redd observed			
	Welsh et. al 2001	2001	An MWAT of 60.8° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	No coho salmon found			
Anderson Creek	CDFG Survey	8/30/1966		Steelhead trout fingerlings and a few yearlings 4-5 inches observed in the first 260 yards	Small beds of loose spawning gravel observed in the first 3/4 mile above the mouth; Pool: Riffle ratio 4:1; Shelter and nursery areas fair	14 log jams; 1 a barrier; 20 ft of bedrock at mouth passable only at high water; Bridge backing up logs and creating a barrier	Remove log jams and old bridge; Manage for anadromous fish
	BLM Survey	7/7/1977		A few juvenile steelhead trout to 2 inches seen in the first 200 yards of the stream	40% good gravels; Pool: Riffle ratio 1:5	The mouth of the creek is of a nature that can only be migrated at high periods; Many log jams found; Fish unable to migrate past a dam 200 yards upstream from the mouth	It is not believed that the creek merits the expense involved in removing the obstructions
	Coastal Headwaters Association Survey	1981-1983	East Anderson appears to have some suitable habitat with a fair amount of debris but salmonid use not yet determined	Reputed to at least support limited runs of steelhead trout		Difficult passage at the mouth up a bedrock chute/falls	
Mill Creek (R.M. 56.2)	CDFG Survey	8/18/1966	Flows through a coniferous forest that has been heavily logged	Steelhead trout and a few coho salmon observed 2-8 inches in length at about 25 fish per 100 ft of stream	About 1 1/2 miles of good spawning gravel; Pool: Riffle ratio about 4:1; Deep bedrock pools provide good shelter	11 log jams	Remove log jams to allow better utilization of 1 1/2 miles of good spawning gravel; The relatively low number of fish in the creek should be taken as an indication of the seriousness of these jams
	Coastal Headwaters Association Survey	1981-1983		Appreciable numbers of coho salmon fry in 1982; Steelhead trout fry and yearlings even more abundant; Juvenile steelhead/rainbow trout up to 12 inches long observed	Gravels often good; Predominantly 1/2 -3 inches with some larger sizes; Pool, riffles, and bedrock falls occur in approximately equal proportions		Prioritize Mill Creek as an excellent candidate for basin-wide rehabilitation work
	CDFG Field Note	6/10/1982	Domestic water being drawn from the stream			5 log jams; 1 a possible barrier	

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Mill Creek (R.M. 56.2) (continued)	CDFG electrofishi ng	7/13/1993		18 steelhead trout caught in a 210 ft reach			
Harris Creek	Coastal Headwaters Association Survey	1981-1983		A few fry and yearling steelhead trout observed just above the County bridge; A stretch electroshocked with CDFG in early fall 1981 about 3/4 of a mile above the mouth indicated that no fish were present this far upstream; Fry, probably steelhead trout/rainbow trout seen in this stretch this spring but in small numbers; Good potential for coho salmon and steelhead trout	Gravels generally small and contain much sand and silt	Many debris accumulations; 17 in the first 3/4 mile above the mouth; One debris accumulation near the county bridge scheduled for work by the CCC	
Gibson Creek	CDFG Survey	1966	Appeared to have little importance as a steelhead trout and salmon spawning stream; Dry and had a mud and sand covered bed				
	Coastal Headwaters Association Survey	1981-1983		Few steelhead trout/rainbow trout fry seen above the county road culvert; Has supported salmonid runs in th e past	Habitat conditions similar to those in Stanley and Harris Creeks		Culvert needs modification to ease adult passage under all flow conditions
	CDFG Field Note	6/10/1982				Culvert under county road is about 3 ft above the Mattole River; Local residents say that under certain high flows in the Mattole River fish do get up into Gibson Creek	
	Letter from Carl Harral, Fish Habitat Supervisor I, to Clyde Edon, Wildlife Conservation Board concerning proposed modifications to barrier modification project on Gibson Creek	10/2/1990	Nearly every resident along Gibson Creek pumps water out of the stream; For most, it is the sole source for their domestic water supply; Residents talked about it being common to have to haul drinking water in the late summer and fall because of poor water quality or because the stream going completely dry; It is my opinion that Gibson Creek does not offer consistent water quality or quantity to maintain a viable population of salmon or steelhead trout; Therefore, I request this proposal be denied funding consideration				
	Memorandum from Kenneth Moore, CDFG, to David Driscoll, CDF concerning Permit inspection and subsequent verification of salmonids in Gibson Creek	6/27/2001	CDFG considers the stream restorable habitat; Residential use of water from Gibson Creek seasonally reduces rearing space for salmonids; CDFG believes that Gibson Creek can recover from past channel aggradation and sedimentation and the adverse effects of the road culvert	CDFG observed salmonids of 2 different size classes in the first two upstream pools from the county culvert inlet which has a vertical drop of approximately 4 ft			

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Stanley Creek	CDFG Survey	8/31/1966	Overhanging trees and brush along and in Stanley Creek made it impossible to survey	Good numbers of steelhead trout fry and fingerlings up to 6 inches observed near the road crossing	Some spawning gravel present; Shelter and nursery grounds appeared to be good for anadromous fish fry		Clear log jams as far upstream as there is sufficient spawning and nursery habitat for anadromous fish
	Coastal Headwaters Association Survey	1981-1983		Coho salmon and steelhead trout fry observed in fair numbers spring 1982 in the lower stretch by the county road; Very few steelhead trout/rainbow trout seen about a mile up from the mouth	Some fair to good spawning gravels occur in conjunction with bedrock; A great deal of deterioration has taken place in the past, creating degraded habitat conditions	Passage hindrance at the mouth which is scheduled for work by the CCC; Significant debris accumulations known to exist in lower reaches; Debris problem areas located in the upper half of the stream	Upland erosion control measures would be beneficial
	CDFG Survey	1/12/1984		One unidentified 3-4 inch fish observed	Spawning habitat fair; Heavy siltation in some areas the major impediment to good spawning habitat; Rearing habitat good	27 obstructions; 18 barriers or possible barriers; Log jam barrier at the confluence with the Mattole River	Manage for anadromous fish; Stream rehabilitation; Consider modification of obstructions to restore eventual natural habitat stability and promote the elimination of excessive siltation; Consider bank stabilization in the stream's upper reach
	CCC Work Proposal	2/25/1986		Three unidentified fishes each about 3 inches long seen at approximately 3000 ft from the confluence with the Mattole River; Since these were the only fishes seen throughout the mile of creek surveyed, it seems the obstruction is hampering fish migration upstream	Stanley Creek has good anadromous fish habitat; Spawning gravel fair and rearing habitat very good; Canopy averaged 65%; Instream cover provided by undercut banks, woody debris, and boulders and bedrock	No major obstructions except culvert on Thorn Road	Work on the barrier should thus receive high priority
Baker Creek	CDFG Survey	8/31/1966		2-4 inch salmonid fingerlings found in good numbers, about 100 per 100 ft of stream	50% of the streambed is spawning gravel; Pool: Riffle ratio about 5:1; Good shelter and nursery areas	13 log jams; No complete barriers	Manage for anadromous fish; Remove log jams to allow fish to move further upstream; Clear jams as far upstream as there is gravel for spawning
	BLM Survey	7/13/1977	Except for the BLM section, the drainage area has been logged	Only a few small salmonids, to 2 inches in length, observed near the mouth	80% good gravels near the mouth; Pool: Riffle ratio 1:4; Pools have good quantities of cover which consist of logs, boulder and bedrock formations		All obstructions seen in the creek will probably be washed out in high flow periods

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Baker Creek (continued)	CDFG Sediment and Bottom Invertebrate Sample Results	7/15/1980	Analyses of sediment samples and bottom invertebrate samples collected on June 14,1980 from Baker Creek conducted; Fines less than 0.85 mm showed a 6.2 % increase in downstream riffles and a 9.9% increase in downstream pools; Fines less than 0.85 mm have been shown to be the most detrimental to eggs and fry; Thus these increases could result in decreases in survival to emergence of 26% in the riffle areas and 41% in the run areas; Lower numbers of macroinvertebrates in downstream pool areas than upstream pool samples; Sample results for substrate composition and invertebrate results for pool areas indicate that sediment had been placed in Baker Creek in quantities deleterious to fish life				
	Coastal Headwaters Association Survey	1981-1983		Both coho salmon and steelhead trout fry observed near the County road; Historically important for salmonids		Instream improvement work scheduled by the CCC for two debris accumulations below the county bridge	
	CDFG Survey	11/10/1982		Approximately 40 2-3 inch steelhead/rainbow trout per 100 ft of stream in the lower section; Approximately 30 2-3 inch steelhead/rainbow trout per 100 ft of stream in the upper section	Good spawning habitat; Gravel loose and small in upper reaches, providing good spawning habitat for coho salmon and steelhead trout; Pool: Riffle ratio 4:1; Good rearing habitat	Many obstructions, one debris jam a possible low flow barrier	Baker Creek offers good spawning and rearing habitat; High priority for log jam removal
	CCC Work Proposal	3/18/1986		Unidentified young-of-the-year salmonids present and numbered 30-40 per 100 ft of stream; Few age 1+ salmonids spotted at 10 per 100 ft of stream	Gravels providing good spawning areas abundant; Pool: Riffle ratio 1:2		
	Memorandum from Larry Preston and Gary Flosi, CDFG, to John Turner concerning a review of 'Salmonid Habitat Conditions in Baker Creek, Humboldt County' by AA Rich and Associates	10/15/1990	'Salmonid Habitat Conditions in Baker Creek, Humboldt County' by AA Rich and Associates summarizes the general character of Baker Creek as a low gradient stream, with adequate water temperatures, shade canopy of 90-100 percent, undercut banks, pools rated good to excellent, and clean spawning gravels with minimal fines; We believe these conclusions regarding the condition of pools and spawning gravels, the impact of earlier stream clearance work, and the impact of past logging are not supported by the document				

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Baker Creek (continued)	CDFG Field Note	2/14/1991	No redds or salmonid carcasses noted				
	CDFG electrofishing	7/13/1993		18 steelhead trout caught and 21 coho salmon caught in a 90 ft reach			
	Letter from Scott Downie Fish Habitat Supervisor II, to Eddie Mendes, Barnum Timber Company, concerning a proposed monitoring program on Baker Creek	11/24/1993	I think that monitoring the overall watershed, stream channel, and biological conditions over a long time period for index purposes is in our interest. We would also hope to identify potential stream and/or watershed improvement activities through our mutual efforts				
	Letter from Eddie Mendes, Barnum Timber Company, to Scott Downie Fish Habitat Supervisor II, concerning a proposed monitoring program on Baker Creek	12/10/1993	Recommend that a Watershed Documentation-Evaluation study, including limiting factor analysis, be done instead of a monitoring study				
	CDFG electrofishing	7/12/1994		88 steelhead trout caught and 2 coho salmon caught in a 158 ft reach; The calculated density of steelhead trout was 0.61 fish/m^2 and coho salmon was 0.01 fish/m^2; The estimated population was 89 steelhead trout and 2 coho salmon			
	CDFG Field Note	12/7/1994		No live fish or carcasses observed; One redd found			
	CDFG Field Note	12/21/1994		2 unidentified live fish observed. One redd found			
	CDFG Field Note	1/4/1995		No live fish or carcasses found; five redds observed			
	CDFG electrofishing	7/20/1995		84 steelhead trout caught and 3 coho salmon caught in a 165 ft reach			
	CDFG electrofishing	7/8/1998		8 steelhead trout caught and 9 coho salmon caught in a 125 ft reach; The calculated density of steelhead trout was 0.19 fish/m^2; The estimated population was 16±7 steelhead trout and 9±5 coho salmon (population estimates include 95% confidence intervals)			
	CDFG electrofishing	7/20/1999		114 steelhead trout caught in a 141 ft reach; The calculated density of steelhead trout was 1.21 fish/m^2; The estimated population was 121±9 steelhead trout (population estimate includes 95% confidence intervals)			

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Baker Creek (continued)	CDFG electrofishing	10/19/1999		23 steelhead trout caught in a 134 ft reach; The calculated density of steelhead trout was 0.49 fish/m^2; The estimated population was 24±2 steelhead trout (population estimate includes 95% confidence intervals)			
	Welsh et. al 2001	2001	An MWAT of 60.8° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	Coho salmon found			
Thompson Creek	CDFG Survey	9/1/1966		Salmonid fingerlings ranging in size from 1-9 inches observed; The upper part of the South Fork had very few fish and all observed were 3-6 inches and thought to be yearling steelhead trout; No first year fingerlings observed above two impassable log jams	Spawning gravel in excellent condition; Pool: Riffle ratio is about 5:1; Shelter and nursery areas excellent	32 log jams; 2 thought to be barriers; A 6ft by 30ft concrete dam is under construction 100 yards from the mouth	Considerable importance as an anadromous fish spawning area; Approximately 1 mile of spawning ground is cut off by log jams on the South Fork; The dam being built must be of a temporary (flash-board) type or must have some facility for passage of anadromous fish
	Coastal Headwaters Association Survey	1981-1983		Supports good numbers of coho salmon; Chinook salmon do utilize Thompson Creek drainage for spawning; Steelhead trout utilize this drainage quite extensively; Electrofishing with CDFG in late September 1981 showed greater numbers of juvenile coho salmon than steelhead trout in the area just below Danny's Creek and near the mouth of Thompson	The mainstem as far as Danny's Creek has stretches of classic Chinook salmon spawning gravels; Pools are abundant although most are quite shallow; Frequent undercut banks provide good rearing habitat; There are silted and embedded gravels	Debris accumulations a problem; Some intermittent problems to adult passage; CCC cleared a forming jam that resulted from a large fallen tree are prevented a serious barrier/erosion problem; Debris jam work is scheduled by the CCC in 4 main spots in the Middle section of Thompson	Priority stream for Chinook salmon population enhancement through the Mattole Hatchbox program;
	Draft Proposal Upper Thompson Creek Barrier Removal 1985-1986	5/81985	Proposal to remove log jams from the upper reaches of Thompson Creek				
	CDFG electrofishing	8/26/1986		55 steelhead trout ranging from 1.2 to 6.4 inches and averaging 2.0 inches in length caught in a 98.4 ft reach; 53 steelhead trout ranging from 1.5 to 8.3 inches and averaging 2.3 inches in length caught in a 328.1 ft reach; 4 coho salmon ranging from 3.0 to 3.3 inches and averaging 3.1 inches in length caught in a 328.1 ft reach			
	CDFG electrofishing	7/13/1993		32 steelhead trout caught in a 150 ft reach			

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Thompson Creek (continued)	CDFG electrofishing	7/7/1994		73 steelhead trout caught and 13 coho salmon caught in a 102 ft reach; The calculated density of steelhead trout was 0.55 fish/m^2 and coho salmon was 0.10 fish/m^2; The estimated population was 73 steelhead trout and 13 coho salmon			
	CDFG electrofishing	7/6/1995		62 steelhead trout caught and 5 coho salmon caught in an 85 ft reach; The calculated density of steelhead trout was 0.52 fish/m^2 and coho salmon was 0.04 fish/m^2; The estimated population was 62 steelhead trout and 5 coho salmon			
	CDFG electrofishing	7/17/1996		141 steelhead trout caught and 31 coho salmon caught in a 90 ft reach; The calculated density of steelhead trout was 1.19 fish/m^2 and coho salmon was 0.22 fish/m^2; The estimated population was 167 steelhead trout and 31 coho salmon			
	CDFG electrofishing	9/21/1998		49 steelhead trout caught and 5 coho salmon caught in a 203 ft reach; The calculated density of steelhead trout was 0.26 fish/m^2; The estimated population was 70±3 steelhead trout and 7±3 coho salmon (population estimates include 95% confidence intervals)			
	CDFG electrofishing	8/11/1999		200 steelhead trout caught and 8 coho salmon caught in a 257 ft reach; The calculated density of steelhead trout was 0.67 fish/m^2 and coho salmon was 0.03 fish/m^2; The estimated population was 238±11 steelhead trout and 10±3 coho salmon (population estimates include 95% confidence intervals)			
	CDFG electrofishing	9/28/1999		139 steelhead trout caught and 9 coho salmon caught in a 230 ft reach; The calculated density of steelhead trout was 0.52 fish/m^2 and coho salmon was 0.03 fish/m^2; The estimated population was 147±18 steelhead trout and 9±6 coho salmon (population estimates include 95% confidence intervals)			

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Thompson Creek (continued)	Welsh et. al 2001	2001	An MWAT of 62.6° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	Coho salmon found			
South Branch of Thompson Creek	CDFG electrofishing	8/26/1986		18 steelhead trout ranging from 1.5 to 2.8 inches and averaging 2.0 inches in length caught in a 65.6 ft reach; 9 coho salmon ranging from 1.8 to 3.0 inches and averaging 2.2 inches in length caught in a 65.6 ft reach			
Yew Creek	CDFG electrofishing	7/13/1993		10 steelhead trout caught in a 200 ft reach			
	CDFG electrofishing	9/6/1995		29 steelhead trout caught and 15 coho salmon caught in a 100 ft reach			
	CDFG electrofishing	9/6/1995		33 steelhead trout caught and 1 coho salmon caught in a 100 ft reach			
	CDFG electrofishing	9/6/1995		27 steelhead trout caught and 10 coho salmon caught in a 100 ft reach			
	Redwood Sciences Lab sampling	9/6/1995		4 coho salmon caught			
	Redwood Sciences Lab sampling	10/4/1995		12 coho salmon caught			
	Welsh et. al 2001	2001	An MWAT of 59.9° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	Coho salmon found			
Helen Barnum Creek	CDFG electrofishing	8/26/1986		7 steelhead trout ranging from 1.7 to 6.1 inches and averaging 2.8 inches in length caught in a 98.4 ft reach			
	CDFG electrofishing	7/13/1993		23 steelhead trout caught in a 100 ft reach			
Lost Man Creek	CDFG electrofishing	7/13/1993		23 steelhead trout caught in a 200 ft reach			
	Welsh et. al 2001	2001	An MWAT of 58.1° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	Coho salmon found			
Ancestor Creek (McNasty Creek)	CDFG electrofishing	8/25/1986		13 steelhead trout ranging from 1.6 to 6.4 inches and averaging 3.0 inches in length caught in a 328.1 ft reach; 17 coho salmon ranging from 2.0 to 3.7 inches and averaging 3.0 inches in length caught in a 328.1 ft reach			

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Ancestor Creek (McNasty Creek) (continued)	Redwood Sciences Lab sampling	8/23/1995		0 coho salmon caught			
	Redwood Sciences Lab sampling	10/12/1995		0 coho salmon caught			
Headwaters of the Mattole River	CDFG electrofishing	8/25/1986		35 steelhead trout ranging from 1.5 to 6.1 inches and averaging 2.3 inches in length caught in a 328.1 ft reach; 16 coho salmon ranging from 2.2 to 3.8 inches and averaging 3.0 inches in length caught in a 328.1 ft reach			
	Welsh et. al 2001	2001	An MWAT of 57.2° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	Coho salmon found			

Western Subbasin

There are 20 perennial and intermittent fish bearing tributaries to the Mattole River in the Western Subbasin (Table 36). There are many documents concerning these streams, including stream survey reports by CDFG and BLM, Mattole Survey Program Annual Reports by the Coastal Headwaters Association, and other documents concerning anadromous salmonid populations and habitat from various sources.

Table 36. Tributaries to the Western Subbasin of Mattole River by River Mile from 7.5 minute topographic maps.

Tributary Name	Confluence (River Mile)	Length (Miles)	
		Permanent	Intermittent
Bear Creek	1.0		0.4
Stansberry Creek	1.3		
Mill Creek	2.8	2.3	
West Fork Mill Creek /Mill Creek Tributary #1		1.1	
Mill Creek Tributary #2		0.5	
Clear Creek	6.1	2.0	
Indian Creek	11.7	2.9	
Wild Turkey Creek	12.7	1.4	
Green Fir Creek	13.2		0.9
Squaw Creek	14.9	12.7	0.7
Granny Creek	19.2	1.7	
Cook Gulch	19.7		1.1
Saunders Creek	19.9	1.4	0.5
Hadley Creek	20.9	1.6	
Kendall Gulch	21.9	1.0	
Woods Creek	24.1	4.2	
Bundle Prairie Creek	25.3	0.5	0.2
Honeydew Creek	26.5	6.9	
Bear Trap Creek		2.8	0.4
High Prairie Creek		1.5	0.5
East Fork Honeydew Creek		5.6	0.8
Upper East Fork Honeydew Creek		2.8	
West Fork Honeydew Creek		2.2	0.6
Bear Creek	42.8	7.2	
French Creek			2.0
Jewett Creek			3.5
North Fork Bear Creek		4.8	0.4
Unnamed Tributary to North Fork Bear Creek		1.9	
South Fork Bear Creek		10.8	0.6
Little Finley Creek	46.7	2.3	0.5
Big Finley Creek	47.4	3.1	
South Fork of Big Finley Creek		2.2	
Nooning Creek	50.2	2.0	

Twenty-five streams in the Western Subbasin were surveyed by CDFG from 1960 to 1990 (

Table 37). Two undated stream survey reports recorded on stream survey forms from the Division of Fish and Game were found. This indicates that these forms were prior to 1951, when the Division became a Department. Those early surveys of Squaw Creek and Honeydew Creek both indicate thriving salmonid populations with high rates of natural reproduction. A stream survey of Bear Creek was conducted in 1952. Steelhead trout young-of-the-year were found in good numbers. Out of 24 streams surveyed in the 1960s, steelhead trout were found in 14, coho salmon were found in five, rainbow trout were found in five, and unidentified salmonids were found in six. High densities of steelhead trout were estimated for the South Fork of Bear Creek (200-300 per 100 feet of stream) in September 1966 and Indian Creek (250 per 100 feet of stream) in June 1966. Coho salmon were found in Mill Creek (R.M. 2.8), Clear Creek, Woods Creek, Bear Trap Creek, and Bear Creek. A stream survey of Mill Creek (R.M. 2.8) was conducted in April 1975. Both steelhead trout and resident trout were found. Out of twelve streams surveyed in the 1980s, steelhead trout were found in four, Chinook salmon were found in one, and unidentified salmonids were found in five. The density of steelhead trout was estimated at 75-100 per 100 feet of stream in Jewett Creek in April 1981. Only 8 steelhead trout were found by electrofishing 650 feet of Bear Trap Creek in March 1981 and no salmonids were observed in Woods Creek in January 1981. Conditions for finding fish were poor on those two occasions, however. A survey of Squaw Creek in March 1985 found 30 juvenile salmonids per 100 feet of stream, 115 redds, 24 adult steelhead trout, and two steelhead trout carcasses. A survey of Squaw Creek in August 1966 had found approximately 150 steelhead trout per 100 feet of stream.

The BLM surveyed 18 streams in the Western Subbasin in 1972, 1977, and 1981. Steelhead trout were found in seven streams, rainbow trout were found in eight, and unidentified salmonids were found in seven. Salmonid densities of more than 50 fish per 100 feet of stream were recorded for Squaw Creek in August 1977, Honeydew Creek in July 1972, Bear Trap Creek in July 1972, the East Fork of Honeydew Creek in August 1972, and the West Fork of Honeydew Creek in July 1972.

The results of surveys on 15 Western Subbasin streams conducted by the Coastal Headwaters Association were summarized in the Mattole Survey Program Annual Report for the 1981-1982 salmon year. Steelhead trout were found in ten streams, rainbow trout were found in two streams, and coho salmon were found in five streams. Coho salmon were found in (Lower) Bear Creek, Clear Creek, Indian Creek, Squaw Creek, and Honeydew Creek. Interviews with local residents indicated that historically Woods Creek, Squaw Creek, Indian Creek, and Stansberry Creek supported runs of Chinook salmon, coho salmon, and steelhead trout while Clear Creek and (Lower) Bear Creek supported runs of coho salmon and steelhead trout.

A 1995 Redwood Sciences Lab investigation found three coho salmon in Big Finley Creek in September but none in Little Finley Creek in August or September.

CDFG electrofishing surveys conducting in the Western Subbasin found steelhead trout coho salmon in Mill Creek (R.M. 2.8), the North Fork of Bear Creek, and the South Fork of Bear Creek with the exception of no coho salmon caught in August 1990, 1992, 1993, July 1995, July 1998 and 1999 on the South Fork of Bear Creek.

Other sources of information about anadromous salmonids in the Western Subbasin included, letters, field notes, BLM Aquatic Habitat Management Plans, MSG Annual Reports, and a Redwood Sciences Laboratory study of juvenile coho salmon distributions in relation to water temperatures in the Mattole Basin (Welsh et al. 2001). Letters to CDFG about Mill

Creek (R.M. 2.8) indicate a recurring problem with a culvert that was detrimental to coho salmon. Other letters concerning Clear Creek, Squaw Creek, and Ross Creek (a tributary to Bear Creek) indicate salmonid habitat degradation in these streams as a result of poor logging practices. CDFG Field Notes indicate that steelhead trout were found in high densities in Indian Creek in July 1969. They were also found in Squaw Creek in March 1963, Stansberry Creek in May 1975, the South Fork of Bear Creek in June 1978, and Honeydew Creek in March 1981, August 1987, and April 1988. Field notes also show that coho salmon were found in Bear Creek in December 1957, Squaw Creek in November and December 1966, and the South Fork of Bear Creek in April 1988. BLM Aquatic Habitat Management Plans have been created for Bear Creek and the South Fork of Bear Creek. A 1984-1985 MSG Annual Report detailed salmonid enhancement projects such as a coho salmon release in Mill Creek (R.M. 2.8) and a planned salmon rearing facility in Squaw Creek. A Redwood Sciences Laboratory study of juvenile coho salmon distributions in the Mattole Basin sampled Stansberry Creek, Mill Creek (R.M. 2.8), Squaw Creek, West Fork Honeydew Creek, Upper East Fork Honeydew Creek, Lower East Fork Honeydew Creek, Bear Creek, South Fork Bear Creek, and Big Finley Creek. Coho salmon were found in Big Finley Creek and the South Fork of Bear Creek.

The BLM has also conducted detailed watershed analyses of Mill Creek (R.M. 2.8) (2000), Honeydew Creek (1996), and Bear Creek (1995). The watershed analysis of Mill Creek (R.M. 2.8) determined that habitat very good for spawning and juvenile salmonids. Winter temperatures are suitable for spawning and mean weekly average summer water temperatures are 56.8°F, which is fully suitable for salmonids. Mill Creek (R.M. 2.8) remains cool because of its deep canyon and dense riparian vegetation. There is a good amount of gravel for spawning though moderate siltation is a problem.

The watershed analysis for Honeydew Creek explains that the Honeydew Watershed is a designated Key Watershed under the Northwest Forest Plan and supports steelhead trout, Chinook salmon, and coho salmon. An estimated 8.57 miles of the Honeydew Creek can be used by salmonids. Honeydew Creek may be one of the most intact watershed in the Mattole Basin in terms of anadromous fish habitats. The upper watershed has escaped the impacts of significant roading, timber harvest, or type conversion. Landslide and erosion mapping shows that the West Fork and Upper East Fork changed little as a result of the 1955 and 1964 floods as the hydrologic conditions are largely intact. However, Bear Trap Creek, High Prairie Creek, and the lower mainstem have been heavily impacted by logging, grazing, and/or subdivision development. Although no data was available to assess fish habitat and populations before WWII, anecdotal evidence suggest that anadromous stocks were abundant and large declines in salmonids have been documented since the early 1980s. Declines in Chinook salmon appear to be related to the degradation of mainstem habitat from sediment inputs from the 1955 and 1964 floods and the land uses that preceded them. Sediment has been stored in the lower gradient reaches of the mainstem of Honeydew Creek, where it continues to impact salmonid habitat.

The Bear Creek watershed analysis describes the creek as supporting populations of steelhead trout, Chinook salmon, and coho salmon. An estimated 19.5 miles of the Bear Creek Watershed can be used by salmonids. Little data exists on the historical or current fish populations of the Bear Creek Watershed. Long-term residents of the watershed state that fish populations have declined dramatically since 1950. Lee French stated that he could walk across fish when he forded Bear Creek in 1930 and 1935. CDFG electro-fishing surveys in the late 1980s and early 1990s found fish densities ranging from 0.08-1.81 fish/m^2. Habitat quality for salmonids has also been dramatically reduced since 1950. Intensive logging and road construction during the 1950s and 60s coincided with large flood events in 1955 and 1964 and resulted in high levels of erosion, which has altered the characteristics of the stream channel. Currently, conditions in Bear Creek are improving. Richard French (Lee French's son) considers that today, stream conditions have returned to pre 1955 conditions (personal communication).

Table 37. Summary of available stream data in the Western Subbasin other than 1990s CDFG stream surveys.

Comments are taken from the various data sources. 1990s CDFG Stream Surveys are summarized in the Condensed Tributary Reports Section of the CDFG Appendix.

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
(Lower) Bear Creek	Coastal Headwaters Association Survey	1981-1983	In late July 1982, creek dry below Lighthouse road culvert	During survey, few fry and yearling steelhead trout noted; One coho salmon fry positively identified through minnow trapping; Historically supported small runs of coho salmon and steelhead trout; According to one long-term resident, Chinook salmon not known to utilize Bear Creek for spawning	Spawning potential fair; Rearing habitat limited	Culvert not a passage problem at high water; 12ft high falls/cascade 0.4 miles upstream from mouth	
Stansberry Creek	CDFG Survey	6/20/1966	Road construction has diverted stream out onto a sand and mud flat in the first 300 yards above the mouth	Steelhead trout fingerlings found in abundance near the mouth but fewer observed above a sand and mud flat	1000 yards of spawning beds; Pool: Riffle ratio 3:1	Sand and mud flat at mouth	Manage for anadromous fish
	CDFG Field Note	5/15/1975	A 150 ft section of creek sampled upstream of a culvert; 7 steelhead trout captured and 5 fish missed due to swift current; A culvert under the county road dumped onto a flat rock posing possible danger to downstream migration				
	Coastal Headwaters Association Survey	1981-1983	Diking and channelization of the lower reaches done nearly a decade ago to prevent flooding and washout of Lighthouse Road; Logged 15 years ago	Electrofishing with CDFG in October 1981 showed young-of-the-year and yearling steelhead trout present in moderate numbers; In the past, moderate numbers of salmon and steelhead known to use the lower portions for spawning; Adult salmon have not been seen for many years but limited runs of steelhead still in evidence	1/4 mile of spawning grounds near mouth destroyed when channel diked and channelized; 1/2 mile of stream accessible to adult salmonids; Rearing habitat provided by frequent small pools, debris jams; root wads, boulders and some undercut banks	Impassable barriers consist of a series of logjams where the gradient steepens considerably; Culvert outfall at Lighthouse Road drops 2 1/2 ft; During the fall of 1981, Humboldt County road crews placed several boulders below the outfall to create a jump pool	Removal of jams not recommended; Should be considered as a future site for direct release of Chinook or coho salmon fry
	Welsh et. al 2001	2001	An MWAT of 59.0° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	No coho salmon found			
Mill Creek (R.M. 2.8)	CDFG Survey	5/21/1966		Approximately 200 fish per 100 ft of stream observed; Of these 70% were steelhead trout from 1-2 inches long, 5% were steelhead trout from 4-6 inches long; and 25% were coho salmon 2-3 inches long	1 mile of spawning area; Pool: Riffle ratio 1:1; Good shelter	8 logjams; No barriers	Manage for anadromous fish; Remove one large logjam; Straighten entrance to culvert

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Mill Creek (R.M. 2.8) (continued)	CDFG Survey	5/15/1975		Estimated 100 salmonids per 100 linear ft of stream in lower 0.1 miles were narcotized and captured with electrofishing equipment; Sizes of juvenile steelhead trout ranged from 1.7-5.2 inches; A few resident rainbow trout found above culvert	Excellent spawning areas in the lower 0.75 stream miles; Pool: Riffle ratio 1:1; Shelter present in the form of boulders, undercut banks and streamside vegetation	12 ft culvert approximately 75 ft from the mouth	
	Letter from John Vargo to Charles Fullerton, CDFG proposing a fish introduction program	7/18/1979				In 1977 the Humboldt County Roads Department repaired a culvert that had been eliminating anadromous fish runs from Mill Creek for a number of years; In the two spawning seasons since the culvert has been repaired we have observed limited numbers of steelhead spawning in the Creek once more; The previous population of coho salmon, however, appears to have been destroyed; What we would like to accomplish is the re-establishment of a coho salmon population in Mill Creek through the use of a Zimmer or Vibert Box for the hatching and protection of eggs and alevins	
	Letter from John Vargo to Steven N. Taylor, CDFG with a Mill Creek Update	2/19/1981				During a recent storm (December 2,3, 1980) the Mill Creek culvert once more scoured out a pool on the downstream end partially destroying the repair work done in 1977; The drop increased from 1 ft to about 3 1/2 ft; During the ensuing month I observed steelhead trout spawners attempting to migrate upstream; Out of the 15 observed attempts to navigate the culvert, 2 were successful; I have also observed limited numbers of spawners above the culvert; The culvert, then, is navigable but with difficulty	
	Coastal Headwaters Association Survey	1981-1983	Headwaters have been logged; but contains about 200 acres of old growth fir			Adult passage blocked by two steep falls, the lower step formed by boulders, the upper by a debris jam	Removal of the debris jam would at least double the length of stream open to adult spawners, but would also release approximately 100 cubic yards or more of impounded sediment
	CDFG Electrofishing	7/9/1984		41 steelhead trout caught and 2 coho salmon caught in a 41 ft reach			

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Mill Creek (R.M. 2.8) (continued)	1984-1985 MSG Annual Report	6/1/1985		Coho salmon have been hatched, reared to yearling size and released at the Mill Creek facility for two previous cycles (1981-82 and 1982-83); The site has not been used since spring 1983 due to a diminished source of eggs in the years of the El Nino phenomena; We hope to resume operations at Mill Creek this coming season; In early December 1984, we documented the first return of coho salmon in nearly 2 decades; This was the result of 10,000 yearlings released by MSG in Spring 1982, coupled with work done previously to improve culvert passage conditions; Evidence of successful spawning was first noted in March, when coho salmon fry were spotted above a formerly impassable logjam (modified by the CCC in 1983 and 1984)			
	CDFG Electrofishing	9/13/1989		102 steelhead trout caught and 7 coho salmon caught			
	CDFG Electrofishing	9/1/1993		107 steelhead trout caught and 13 coho salmon caught			
	Welsh et. al 2001	2001	An MWAT of 59.0° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	No coho salmon found			
Clear Creek	CDFG Survey	6/21/1966		Coho salmon and steelhead trout, 1-3 inches long found throughout most of the creek; Averaged about 100 fish per 100 ft of stream	Good spawning gravel intermittent; Sheltered pools provide excellent nursery areas	5 logjams; one five ft natural falls; 1 Culvert	Manage for anadromous fish; Clear all the logjams
	Coastal Headwaters Association Survey	1981-1983	Logged in lower reaches	Electroshocking with CDFG just above the culvert in October 1981 showed juvenile steelhead trout to be extremely abundant; An August 1982 survey confirmed this abundance of steelhead trout, particularly fry; In addition, 2 dozen coho salmon young-of-the-year sighted in pools; No young-of-the-year salmonids 0.3 miles from the mouth; Historically supported runs of coho salmon and steelhead trout; Few if any Chinook salmon were known to spawn here	Streambed fairly silted and gravels patchy in distribution, with the result that there are few suitable spawning grounds; Good rearing habitat provided by frequent small pools with adequate instream cover	25 ft bedrock waterfall 0.7 miles upstream	Priority stream for improvement; Recommend selective trimming or removal of instream debris in the lower 1/2 mile of stream and seeding riparian and upslope areas

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Clear Creek (continued)	Letter from David Simpson, MSG, to Mike Hudson, CDF, concerning a Timber Harvest Plan in the Clear Creek watershed	2/4/1985	Almost all of the Clear Creek watershed other than the 67 acres in the Timber Harvest Plan have been logged with insufficient restriction to prevent serious damage; There are problems with erosion, debris in the stream channel, stored sediment, channel migration, sedimented gravels, and a lack of pools; Suggest precautions be taken to keep more debris and sediment out of the river, and that the State forestry and fisheries people, the timber operator, MSG and maybe adjacent landowners get together to make a commitment towards improving the quality of Clear Creek	In 1983 our project biologist trapped and released not only young-of-the-year steelhead trout but also coho salmon			
	Letter from Benjamen Kor, CRWQCB, to Brian Anker, Eel River sawmills concerning a landslipe in the Clear Creek watershed	1/28/1991	On January 18, 1990, Regional Board staff conducted an inspection of a timber harvest plan in the Clear Creek watershed in response to a public complaint; The inspection revealed that harvest activities had resulted in the reactivation of an old slide; The slide is discharging sediment into Clear Creek; Regional Board Staff also obser ved other erosional problems associated with timber harvest activities which should be corrected to reduce the sediment discharge to Clear Creek				
	Fish Removal Report prepared by Tetra Tech (MFG) Consulting Scientists and Engineers for NMFS	10/12/2000		On August 31, 2001, Tetra Tech (MFG) conducted fish removal from Clear Creek for Humboldt County Department of Public Works prior to construction activities associated with the Clear Creek at Mattole Road culvert replacement project; As water temperatures in the Mattole River were 23° C, and flows in Clear Creek were subsurface below the culvert plunge pool it was determined that the most suitable relocation sites were upstream of the project area; 80 steelhead trout young-of-the-year and 3 steelhead trout age 1+ were captured			

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Indian Creek	CDFG Survey	6/23/1966		Steelhead trout fingerlings observed throughout; Averaged 250 fish per 100 ft of stream; Many 4 inch and a few 6 inch steelhead and/or resident trout observed	Short stretches of spawning gravel throughout the first 0.75 miles; Pool: Riffle ratio 1:1; Excellent nursery ground	32 logjams; 3 partial barriers; 1 culvert	Remove several of the jams; Manage for anadromous fish
	CDFG Field Note	7/16/1969	Water temperature 63°F	Spot Electrofishing sampling to determine species present; Juvenile steelhead trout very abundant - 200+ per 100 ft of stream; fish were in excellent condition			
	CDFG Survey	3/30/1981			Spawning gravel abundant; Pool: Riffle ratio averaged 1:4; Nursery grounds abundant	15 obstructions; 4 possible barriers	Contains productive habitat for anadromous salmonids; Rehabilitation projects (dam removal) would enhance the resource
	Coastal Headwaters Association Survey	1981-1983	Most of the watershed has been logged and/or burned sometime in the past	In October 1981, a short stretch electrofished with CDFG and juvenile steelhead trout found to be extremely abundant; Ocular appraisals in mid-August 1982 confirmed abundance of juvenile steelhead trout, especially young-of-the-year; Small numbers of young-of-the-year coho salmon observed from the mouth to about 1/2 mile upstream; Our surveys indicate that moderate numbers of steelhead trout and a few coho salmon still utilize Indian Creek for spawning and rearing; Present usage by Chinook salmon is unknown, though one local resident reported seeing spawning Chinook salmon in Indian Creek in the early 1970s; Historically had considerable runs of Chinook and coho salmon and steelhead trout;	The few available spawning areas are moderately to heavily silted; Good to excellent rearing habitat exists nearly throughout the surveyed portion	Frequent accumulations of large woody debris in the channel, though none appear to present barriers; Some instream debris removal done by CCC crews about 5 years ago	Additional debris trimming work warranted; Priority stream for habitat protection and improvement
	CDFG Survey	1/22/1985		Juvenile salmonids observed	Spawning habitat adequate for steelhead trout and rainbow trout from about 2500 ft to 6500 ft above the mouth; Spawning habitat possibly suited to coho salmon as well; Pool: Riffle ratio 1:15 for first 2500ft, 1:1 for middle portion and 3:1 in upper reaches; Rearing habitat poor for first 1000ft but excellent above 2500ft from the mouth	1 culvert; Several jams noted; Some possible barriers	High concentrations of fine sediments are a problem; Reduce the amount of fine sediment
Green Fir Creek	CDFG Survey	8/9/1966		Steelhead trout fingerlings observed throughout first 3/4 mile of stream; No fish over 4 inches observed	Small gravel spawning beds abundant throughout the first 3/4 mile surveyed; Pool: Riffle ratio 2:1; Shelter and nursery areas fair	12 logjams; 2 were partial; 8 ft falls at mouth passable only at high water	Manage for anadromous fish; Remove all loose logs and debris

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Green Fir Creek (continued)	Coastal Headwaters Association Survey	1981-1983	Severely impacted by past careless logging, in which the creek channel was used as a skid trail	Supports a limited run of steelhead trout; Young-of-the-year steelhead trout present in moderate numbers from the mouth to about 0.5 miles upstream		Large amounts of logging debris in the channel that apparently do not seriously hamper adult fish passage	
Squaw Creek	CDFG Survey	Pre 1951	Stream flows through clay formation in places which tends to discolor water; These formations often result in heavy land slides	Steelhead trout and salmon mature fish in stream to spawn or 1st year offspring of these adults present; Natural propagation probably very extensive	Spawning grounds common		Natural reproduction should keep stream stocked under present conditions
	Note from Ralph McCormick, CDFG, Jack Andrews, CDFG, George Black, USFWL, and Jim Heckman, USFWL	6/20/1957	Traveled up creek to inspect cause of heavy siltation; 3.8 miles up log road is small tributary that contributes all mud-- up the tributary is loading area-- skid logs down gully in mud and water and into gully from sides-- this is cause of all mud from here down, above this tributary water in Squaw Creek is clear; From this tributary down the log trucks go down the creek and make 26 crossings in 2.2 miles; Above the muddy tributary noted abundant small steelhead trout, some recently hatched; This whole creek should be investigated again with the CDFG Warden for the area; Surely this misuse of a stream can be cited as a violation; Should seine above and below silt source and take bottom samples for relative amounts of insect life above and below the source of silt; This should show any deleterious effects of silt upon the stream life				
	CDFG Field Note	3/21/1963		10 live and 2 dead steelhead trout observed in 1 1/2 miles of stream; Steelhead trout actively engaged in spawning			
	CDFG Survey	8/10/1966	80% of observed hillsides logged in the past; Road fords the creek 10 times between tributaries 3 and 4	Steelhead trout fingerlings and yearlings observed throughout the creek; Approximately 50% of the fish were 4 inches or larger; 6-7 inch fish were common; Approximately 150 fish per 100 ft of creek	8 miles of good loose spawning gravel in the main branch; Pool: Riffle ratio 1:1; Shelter and nursery areas good due to deep pools and overhanging logs; First two miles from the mouth had poorer shelter and nursery area because most pools were filled in with gravel	25 logjams; No complete barriers; 1 4 ft rock falls; 1 completely log jammed culvert	Manage for anadromous fish
	CDFG Field Note	11/22/1966 and 12/11/1966		11/22/1966: 6 adult and 10 juvenile coho salmon seen; 12/11/1966: 4 adult and 1 juvenile coho salmon seen			

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Squaw Creek (continued)	Letter from ET Miller, Assistant Fishery Biologist, CDFG, to W. Ferroggiaro, District Attorney concerning fish in Squaw Creek	10/20/1971	Made an inspection of the fish population of Squaw Creek on July 13,1971 near a logging operation by Goff Brothers; The creek was muddy below and in the site of the logging operation; The muddy water began at the upper ford about 100 yards below a culverted dirt fill road crossing; The stream became muddier as it flowed through the operation; The section of stream sampled had been adversely affected by the introduction of mud and other materials and was not in a natural undisturbed condition; Sampling downstream was not possible because of muddy water; Water samples taken about 250 ft below the culverted crossing had a pH of 9 and an oxygen content of 10ppm; On July 15, 1971, returned to sample about 3/8 of a mile upstream from the culvert; Through this section the stream was about 80% pools with depths down to about 5 ft; The electrofishing unit did not function properly and it was not possible to secure a regular population estimate, however, it was estimated that the population was in excess of 100 fish per 100 ft of stream; The conductivity of the water was higher than the electrofishing unit was designed for	A measured section of the stream was electrofished and a population estimate of 72 trout per 100 ft of stream was calculated			
	BLM Survey	8/10/1972	Badly damaged by logging over much of its length; Fire has also had an adverse effect on the stream	Steelhead trout use the stream; Potential for coho salmon and below the forks for Chinook salmon; Resident rainbow trout observed	Spotty spawning gravels; Rearing areas more common	Many barriers; Waterfalls in both branches that are complete barriers	Manage for anadromous fish; Will probably prove to be a major spawning stream; Manage for resident fish in the upper areas
	BLM Survey	8/2/1977	Much of the drainage has been logged	Rainbow trout/ steelhead trout found near mouth, but not in numbers as great as the upper section surveyed; Young-of-the-year fish seen near mouth and a 4 inch fish caught; Resident rainbow trout sampled in the upper BLM section; These fish found from 1-7 inches in length and quantities estimated at 50-100 per 100 ft of stream	Many good spawning gravels; Pool: Riffle ratio near mouth 1:8, 1:2 to 1:1 in the BLM section; All pools have good cover; All surveyed sections have excellent fish habitat		Manage for anadromous fish

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Squaw Creek (continued)	Coastal Headwaters Association Survey	1981-1983	Fifth largest tributary of the Mattole River; Most of the watershed has been logged in the past	Appears that few salmon still spawn here, but moderate runs of steelhead trout are still in evidence; Minnow trapping near the mouth this spring showed the presence of young-of-the-year and yearling coho salmon and steelhead trout; Historically had good runs of Chinook salmon, coho salmon and steelhead trout	Historically good spawning and rearing habitat		
	CDFG Survey	1/28/1985		The lower 30,000 ft of Squaw Creek surveyed on Jan 28th and 29th; Two live salmon, probably Chinook salmon, 1 steelhead trout, 3 salmon skins, 1 juvenile salmonid and 21 redds observed; The stream section above 30,000 ft surveyed March 21st and 22nd; Numerous juvenile salmonids (30 per 100 ft of stream), 115 redds, 24 adult steelhead trout and two steelhead trout carcasses observed	Spawning habitat fair to good in first 6000 ft, poor from 6000-11000 ft, fair from 11000-26000 ft, good from 26000-38600ft, poor from 38600-51500ftfair from 51500-54500ft, and poor to fair for the remainder of the survey; Pool: Riffle ratio 1:10 for first 6000ft, 1:7 from 26000-38600ft, 1:1 from 38600-51500ft, and 1:2 from 51500-54500ft; Rearing habitat was limited in the first 38600 ft, excellent from 38600-51500ft, and good from 51500 to the end of the survey	Many logjams and debris jams	The major problem with the Squaw Creek watershed is the introduction of fine sediment into the system from many large slides; Fine sediment has degraded spawning gravels and especially rearing habitat, primarily in the lower 7 miles of stream; The numerous slides, their large size, and very limited access to Squaw Creek make it infeasible, if not impossible, to control the influx of sediment into the creek; However, the possibility of increasing rearing habitat with structures in the middle portion of the stream (ie. 26000 to 38000 ft does exist; Any improvement of rearing habitat from 26000-38000ft would probably increase fishery production as lack of rearing habitat is probably the limiting factor to production.
	1984-1985 MSG Annual Report	6/1/1985	During the fall of 1984, MSG installed two water intakes, filter barrels, and a hatchbox along lower squaw creek. However, the site remained dormant this past winter because of marginal water flows and the disappointing upriver take of Chinook salmon eggs; Facility improvements are planned that will make this site fully operational for the 1985-86 salmon season	Historically, the creek supported significant populations salmon, but current spawner escapements have dwindled to the point where available habitat is notably underseeded; Squaw Creek is thus a prime candidate for population enhancement of Chinook salmon through the use of hatchboxes			
	Welsh et. al 2001	2001	An MWAT of 68.9° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	No coho salmon found			
Granny Creek	CDFG Survey	8/8/1966	Intermittent with numerous pools only above the bridge; may dry up in late summer	A few steelhead trout fingerlings observed in pools above the bridge; No fish larger than 2"	Small beds of spawning gravel abundant above the bridge; Shelter and nursery areas poor due to shallow pools and removed vegetation	10 log jams; No barriers	Remove some logjams; Manage for anadromous fish only; Check at the end of summer as it may dry up

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Cook Gulch	CDFG Survey	8/9/1966	Less than 0.25 cfs flow and dry at mouth; Logging slash, boulders, and rubble make the per portion of the stream unsuitable for spawning	No fish observed	200 yards of good spawning gravel at mouth	No stream obstructions recorded	Manage as an anadromous fish stream of little importance
Saunders Creek	CDFG Survey	8/9/1966		A few yearling steelhead trout observed in pools	1/2 mile of good spawning gravel; Pool: Riffle ratio 1:3	No stream obstructions recorded	Manage as an anadromous fish stream of little importance
Kendall Gulch	CDFG Survey	8/9/1966	Headwaters in heavily logged coniferous forest; Less than 0.25 cfs flow and dry at mouth	No fish observed	100 yards of gravel suitable for spawning; Only a few shallow pools for shelter and nursery areas	No log jams, 1 culvert	Manage for anadromous fish
Woods Creek	CDFG Survey	8/9/1966		About 200 fish per 100 ft of stream observed; 35% of these were yearling steelhead trout; The rest were fish of the year with few coho salmon	Estimated 1 mile of spawning gravel; Pool: Riffle ratio 3:1; Good nursery areas	6 log jams	Manage for anadromous fish; Remove three large log jams
	BLM Survey	8/4/1972	Second growth in lower parts of the stream, but recent signs of logging in upper reaches; South fork might have been important at one time, but logging operations have obliterated it, so that it is mostly water flowing through the trash of logging	Few fish seen, mostly in the lower reaches; While scattered along the stream, they were never abundant; Size and markings indicate steelhead trout with possible resident rainbow trout	Long stretches of flowing water offer little spawning potential because of the large bottom material interlaced with fines and silt	Older log jams have washed out	Manage for anadromous fish
	CDFG Review of negative declaration of a Humboldt County Bridge Replacement project on Woods Creek	7/5/1974	A bridge should not impair fish passage whereas a culvert might result in some degree of impairment				
	BLM Survey	8/1/1977	Dry for first 0.75 miles; Much of the drainage has been logged in the past, but the BLM headwaters contains much harvestable timber	No fish observed	No good gravels concentrated enough to be used by salmonids for spawning; Pool: Riffle ratio 1:2; Pools plentiful but cover scarce	No barriers observed	
	CDFG Survey	1/7/1981		No adult salmonids or salmonid fry observed, although conditions poor for observation	Relatively little suitable spawning gravel for use by anadromous fish; Pool: Riffle ratio 1:10 just above bridge, 1:3 in middle section, and 1:1 at end of survey	Some log jams; 1 bedrock falls	Existing habitat appears to be marginal for anadromous fish; However, the surveyed section could support some species, especially steelhead trout and resident trout; Manage section above the end point of the survey for resident trout; Stream clearance is not recommended
	Coastal Headwaters Association Survey	1981-1983	Past careless logging practices on steep slopes directly adjacent to the stream; In most of middle reach, large amounts of angular gravel and cobbles in the main channel indicate recent major contributions of slide debris to the stream	Recent reports from local residents and information from our surveys indicate that few salmon still ascent the creek to spawn; Once supported moderate runs of Chinook salmon, coho salmon, and steelhead trout	Fish habitat conditions fair to poor; Dominant rock-rubble substrate contains large amounts of sand and silt, with the result that suitable spawning areas are few and far between	Log jams exist but none block the entire channel	Reseed landslide slopes along the main channel and tributaries
Honeydew Creek	CDFG Survey	Pre 1951	Water never warms up and stream carries a good flow in all seasons; Subject to heavy freshets in winter	Steelhead trout and salmon present; Natural reproduction plays a big part in keeping the stream stocked	Spawning grounds common; Good nursery stream	No obstructions	Stock steelhead trout annually

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Honeydew Creek (continued)	Letter from GC Francis, BLM District Manager, to John Day, CDFG concerning stream survey cooperation	4/3/1964	We would like to propose that you survey the Honeydew Creek drainage this summer; In return we would undertake to survey as many possible of the small streams on the west slope of the King range				
	CDFG Survey	6/23/1964		Salmonids present throughout the entire drainage; Size from fingerling stage to 12"	Excellent spawning areas; Pool: Riffle ration 1:1; Excellent nursery areas	No obstructions on the mainstem	Manage for anadromous fish and resident fish
	Letter from John Day, CDFG, to the BLM concerning turbidity in Honeydew Creek	1/7/1966	Warden Null reported that road culvert installations on BLM land were causing turbid water conditions to exist in the Mattole River; The turbid waters were originating in the Honeydew Creek drainage during December 1965; Warden Null stated that turbid waters were interfering with steelhead trout fishing; Many complaints were voiced to him by fisherman				
	Letter from John Lang, BLM, to John Day, CDFG concerning turbidity in Honeydew Creek	1/14/1966	Several large culverts remain to be installed this year; We will insure that our contractor do as little damage to the stream as is physically possible				
	BLM Survey	7/11/1972		More than 50 salmonids per 100 ft of stream up to 10 inches observed		No barriers	
	BLM Survey	2/4/1981		An adult salmon observed near confluence of East Fork Honeydew Creek; Four steelhead trout redds observed near Bear Trap Creek confluence	Optimum spawning habitat; Pool: Riffle ratio 1:10 near mouth, 1:3-6 mid survey, and 1:10 at end of survey; marginal rearing habitat in lower stretches due to poor shading and low availability of escape cover	No barriers	Enhance rearing habitat in the lower 2.5 miles of stream
	CDFG Spawner survey	3/1/1981		7 steelhead trout spawners observed			
	Coastal Headwaters Association Survey	1981-1983	Extensive groves of mature trees and young riparian vegetation occupy alluvial areas of lower Honeydew Creek; Oxbow cutting is taking place near the mouth	Extensive populations of young-of-the-year and yearling steelhead trout observed in low water surveys; minnow trapping revealed the presence of coho salmon juveniles; Fresh redds and spawning steelhead trout observed this winter and spring several miles up the main creek			
	CDFG Survey	1/29/1985			Fair spawning habitat for steelhead trout and resident fishes; Spawning gravels located only in small patches		Manage the upper section of Honeydew Creek from the confluence of West Fork Honeydew Creek and upstream for steelhead trout and resident trout

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Bear Trap Creek	CDFG Survey	8/25/1960	Mr. Shinn states that "hook bills and steelhead go upstream to spawn and culvert doesn't seem to stop them"; Stream dries up from culvert to mouth	About 300 steelhead trout and coho salmon from 1-4 inches observed	Fairly good spawning ground with quite a few sand bars; Shelter provided by overhanging log jams	1 waterfall; 3 logjams; No barriers; 10 ft culvert	
	CDFG Survey	6/23/1964	Stream mouth was dry	Many fingerling steelhead trout observed; Some salmonids up to 6 inches seen; Many rainbow trout fingerlings seen, seined, and identified	Adequate amount of spawning area; Pool: Riffle ratio 1:1; Pools not deep but evidently satisfactory	1 log obstruction; No barriers	Many, possibly thousands of fingerlings are trapped in this stream when the mouth goes under gravel in the early summer; Something should be done to permit these fish to migrate naturally downstream
	BLM Survey	7/14/1972		Salmonids abundant, 50+ per 100 ft of stream throughout; Ranged in size from 2-6 inches	From the mouth to 1 mile upstream 25 square yards of good and 170 square yards of marginal spawning gravel; Pool: Riffle ratio 1:3; Shelter provided by large boulders and logs in stream, and large mats of algae in the lower reaches	Several logjams; 10 ft waterfall 615 yards upstream is a barrier	Manage lower 1/4 mile as an anadromous spawning area; Manage for resident species above waterfall
	CDFG Survey	3/23/1981		A 650 ft section at the mouth electrofished: 8 steelhead trout caught; Water conditions not ideal for electrofishing	Marginal spawning habitat; Gravel somewhat compacted, silted, and fairly angular; Pool: Riffle ratio 1:5; Marginal rearing habitat	Several logjams; 4 barriers	Stream rehabilitation, if done, should be confined to obstructions mentioned; Low priority
	Honeydew and Bear Creek Restoration Plan produced by Natural Resources Management Corporation	4/16/1996	A landing with perched fill and poor drainage is located at the end of Bear Trap West Road where it crosses Bear Trap Creek; A plan that will put the perched fills, slope back the crossings, and add rolling dips is recommended for this road				
High Prairie Creek	CDFG Survey	8/25/1964	Immediate hillsides and stream bank show evidence of extensive erosion; Flow intermittent	No fish observed	Streambed from mouth to 3/4 mile upstream is about 75% gravel 1-3 inches; Very little shelter available	11 log jams; 1 culvert; No natural barriers	
	CDFG Survey	3/23/1981	Bank instability a major problem	A section from the most upstream extent of the culvert to about 500 ft upstream was spot electrofished: no fish caught	Gravel abundant, but too small, compact, and silted to be of much use to spawning salmonids; Pool: Riffle ration averaged 1:5;	5 logjams; 1 culvert; 6 possible barriers	Low priority for rehabilitation projects

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
High Prairie Creek (continued)	High Prairie Creek Culvert Improvement Project Final Report	8/12/1985				In August 1984, a salmonid migration barrier at the High Prairie Creek culvert was partially corrected by constructing a three step concrete fish ladder on the existing apron below the culvert; The fish ladder has improved conditions for adult salmonid passage, offering access to about two miles of previously un-utilized spawning and rearing habitat for steelhead trout and coho salmon; However, field observations indicate that the fish ladder may not be completely effective because the slope of the culvert itself is too steep; Culvert baffles, originally planned but not installed, are needed to ensure spawner access over a wider range of flows	
East Fork Honeydew Creek	CDFG Survey	6/23/1964		Salmonids present throughout the entire drainage; Size was from fingerlings stage to 6 inches long	The first mile upstream from mouth is good spawning grounds; Upper portions had very little gravel; Plenty of shaded areas along with deep pools throughout the stream	Three log jams	
	BLM Survey	8/3/1972		Salmonids, 2-8 inches in length abundant, 50+ per 100 ft of stream, throughout the stream with the exception of the area above the falls where no fish were seen	Three hundred square yards of suitable salmonid spawning gravel; Pool: Riffle ratio 1:5; A moderate amount of shelter found in the stream	7 logjams; 1 6 ft waterfall	Manage for anadromous fish
	BLM Survey	10/27/1972	This survey focused on stream reaches above those surveyed on 8/3/72; Logging and road failure has led to a continual series of minor erosion areas, logs and debris in the stream; and boulders which have eroded into the channel	Some rainbow trout, but small numbers	The only spawning area in the stream occurs at the tail of pools, or in alluvial deposits; neither represents a good area, as they are subjected to scouring and to considerable movement of material; Cover fair	Major slide area; Quarter mile wide log jam and alluvial deposition; A lot of logs and debris in the stream	Rehabilitate stream as much as possible; Manage for resident rainbow trot and steelhead trout
	CDFG Survey	2/20/1981		One steelhead trout (approximately 24 inches long) observed 400 ft above the first obstruction	Good spawning habitat; Pool: Riffle ratio 1:15 downstream, 1:1 - 1:2 in middle reach, and 1:3 in upper reach; Good rearing habitat	1 possible barrier	Manage for anadromous fish; Some stream enhancement may be desirable
	CDFG Project Sheet	1983	Failure to remove a debris jam has created the largest sediment producer within Honeydew Creek Watershed; If stream flow is not channeled away from this ridge-toe soon the other half of the ridge will slip into Honeydew Creek; Project objective: shape stream channel to its natural flow pattern and armor ridge toe with debris				

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Upper East Fork Honeydew Creek	BLM Survey	8/29/1972	A massive landslide area is visible from some distance away and has dumped much material into the stream	The whole stream has fish but they are nowhere numerous	Some spawning areas; Some rearing areas		A spawning-rearing area without too much capacity
	CDFG Survey	1/29/1985		Three juvenile salmonids (1- 2 1/2 inches) seen	Spawning area fair for steelhead trout and non-existent for salmon; Good rearing habitat provided by boulders and woody debris		Low priority stream for rehabilitation; Manage for steelhead trout and resident trout
	Welsh et. al 2001	2001	An MWAT of 63.5° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	No coho salmon found			
Lower East Fork Honeydew Creek	Welsh et. al 2001	2001	An MWAT of 66.2° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	No coho salmon found			
West Fork Honeydew Creek	CDFG Survey	6/24/1964		Rainbow trout seined and caught which ranged from 2-12 inches in length; Reduced numbers of salmonids found above a log jam	Spawning conditions good for salmon and steelhead trout in lower 3/4 mile of stream; Gravel loose, and ranged from 2- 8 inches in diameter; Pool: Riffle ratio 1:1 in lower reaches; Ample shelter under rocks and undercut banks throughout the portion surveyed	2 log jams; 1 possible barrier	Manage for anadromous fish and resident trout
	BLM Survey	7/14/1972		Salmonids up to 6 inches long seen at more than 50 per 100 ft of stream	Marginal spawning gravel		
	BLM Survey	9/17/1972		Rainbow trout up to 7 inches long seen at 6-50 per 100 ft of stream	Marginal spawning gravel		
	CDFG Survey	2/18/1981			Good spawning habitat; Pool: Riffle ratio 1:5 near mouth and 1:3 at end of survey; Good rearing habitat	1 large log jam creating a 4 ft falls	Remove barrier; Riparian planting to increase bank stability
	CDFG Survey	1/29/1985		3 redds observed	Spawning habitat fair; Spawning gravel located in patches and well rounded and loose with some siltation; Rearing habitat good	1 log jam; 1 boulder jam	Low priority stream for rehabilitation; Manage for steelhead trout and resident trout
	Welsh et. al 2001	2001	An MWAT of 62.6° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	No coho salmon found			
Bear Creek	CDFG Survey	6/8/1952		Steelhead trout young-of-the-year in good numbers	Good gravel		
	CDFG Field Note	12/13/1957		Observation about 1 mile upstream from Shelter Cove Road Crossing over Bear Creek on riffle saw about 10 coho salmon spawning; Reports that there were several more "bunches" below bridge			

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Bear Creek (continued)	CDFG Survey	6/20/1966		A few 1-3 inch steelhead trout and coho salmon observed in the lower stretches of the creek, about 20 per 100 ft of stream	First 150 yards of stream bed above the mouth composed mostly of fine gravel and silt; Above that streambed changes to solidly embedded coarse rubble with no suitable spawning gravel; Shelter and nursery areas limited due to shallow water	No obstructions	Manage for anadromous fish
	CDFG Survey	8/23/1966		100 salmonids per 100 ft of stream observed; About 10% of these were yearlings, the rest being fingerlings; A few resident trout 8-10 inches observed in deep pools; About 20 depressions assumed to be old redds observed in lower mile	Approximately 2 miles of good loose spawning gravel; Pool: Riffle ratio 2:1; Undercut banks and large boulders form many sheltered areas	1 logjam, 2 man made gravel dams	Manage for anadromous fish; Provide passage around gravel dams
	BLM Survey	8/11/1972		From the mouth to 3 miles upstream only 5 salmonids per 100 ft of stream, sizes ranged from 2-6 inches; Above this point salmonids seen at 40 to 50 fish per 100 ft of stream, sizes ranging from 2-6 inches though one steelhead trout 12 inches in length and one 18 inches long found	From the mouth to 3 miles upstream several thousand square yards of good spawning gravel; Above this to forks about 200 square yards of good spawning gravel; Pool: Riffle ratio 1:2; Very little shelter in lower 3 miles of stream; Above this, abundant shelter in the form of pools, cut banks, and large rocks	1 logjam; 7 slides in channel	Manage for anadromous fish
	BLM Survey	7/28/1972		Salmonids up to 12 inches seen at 6-50 per 100 ft of stream	Marginal spawning gravel		
	Coastal Headwaters Association Survey	1981-1983	Overall condition extremely deteriorated; Force of water flowing through canyon in upper reaches is enormous;	Good populations of young-of-the-year and yearling steelhead trout/rainbow trout present; One piece of salmon carcass found on a spawner survey in mid-January	Good sized spawning gravels infused with large amounts of fine sand, silt, and clay; Some good pools found occasionally		Revegetation and erosion control opportunities extensive
	CDFG Project Sheet	1983				CDFG, CCC, and BLM have helped restore the runs of Chinook and coho salmon in Bear Creek by removing barriers to migrating fish; However, there is no rearing habitat for coho salmon within a 2 1/2 mile section of Bear Creek; This section is downstream from known (1982) coho salmon spawning areas	The first step that should be taken to restore rearing habitat here is to restore the riparian habitat; Project objective: to increase the degree of stream shading from less than 10% to 70%

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Bear Creek (continued)	Bear Creek Aquatic Monitoring Plan by the BLM Arcata Resource Area	9/30/1996	This document outlines a monitoring plan for the Bear Creek Watershed; Although this document was prepared in response to BLM's needs to monitor the effectiveness of actions tied to the Northwest Forest Plan, the actions described in this document will be conducted and funded by many other agencies and groups such as MSG, CDFG, EPA, and the California Coastal Conservancy				
	Welsh et. al 2001	2001	An MWAT of 70.7° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	No coho salmon found			
Ross Creek (Tributary to Bear Creek)	Memorandum from David Rogers, CDFG, to Don La Faunce	8/21/1973	Ross Creek inspected on August 10, 1973 from upper end of current logging to confluence with Bear Creek; Over the logged area all vegetation had been removed down to the creek bed; The entire creek bed and bank had been obscured by tractors operating in and along the creek; At several points the stream had been blocked by soil and logging debris; All pools had been filled with soil; To me, it appeared that the stream bed had been used to skid logs to the landing which was located in the streambed; About 200 yards below the lower end of the disturbed area and just above a small tributary entering from the left, a six inch rainbow trout/steelhead trout was observed; Further downstream more fish were observed, ranging in size from about 2 1/2 to 6 inches; The aquatic life of this stream, Bear Creek, and the Mattole River will suffer from the effects of this logging operation; The amount of sediments washing down the stream during the winter will be substantial, not to mention the destroyed habitat in the immediate vicinity of the logging operation				
French Creek	CDFG Survey	1966	Dry at the time of the survey	According to local residents, few if any fish use creek for spawning	Very little spawning gravel observed; Poor habitat for fish	No obstructions	Manage for anadromous fish

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Jewett Creek	CDFG Survey	5/19/1965	Approximately 1/4 mile flowing under ground when surveyed	Steelhead trout fingerlings observed up to the first logjam barrier; A few 4-5 inch steelhead trout yearlings observed	1 1/2 miles of good loose spawning gravel; Pool: Riffle ratio 1:4; Fairly poor shelter and nursery areas	22 logjams; 2 barriers	Manage for anadromous fish only; Remove all loose logjams; Leave well silted logs as they form most of the shelter in this creek
	BLM Survey	9/20/1977	Stability of banks and canyon walls is poor	Juvenile steelhead trout observed; Numbers of fish estimated at 25 per 100 ft of stream; Most fish observed close to 3 inches in length	Spawning gravels abundant and well suited for steelhead trout; Pool: Riffle ratio 1:4 in upper reaches and becomes lower near the mouth	4 logjams; 1 barrier	Excellent anadromous fisheries stream; Fish barrier represents no problem to the fishery because of the poor habitat above this barrier
	CDFG Survey	3/23/1980	Logged 25 years ago	Salmonid fry observed throughout the drainage; Ranged from 1-4 inches in length	Spawning habitat plentiful; Pool: Riffle ratio 1:10; Rearing habitat plentiful	Many log and debris jams; 1 passage barrier	High priority for stream rehabilitation; Clear stream of obstructions through jam immediately before passage barrier
	CDFG Survey	4/8/1981	Resurveyed to see if winter storms had created new obstacles to fish migration	An abundance of 1 inch long young-of-the-year steelhead trout; 75-100 fish per 100 ft of stream below fish barrier		6 log jams; 1 possible barrier; 1 complete barrier	Alter obstructions to allow better fish passage
	CDFG Survey	10/19/1982	Resurveyed to see if winter storms had created new obstacles to fish migration	Numerous salmonids observed	Pool: Riffle ratio 1:7	3 logjams; 2 potential barriers	Resurvey periodically to ensure that obstructions do not form into complete barriers
North Fork Bear Creek	CDFG Survey	8/23/1966	Watershed logged in the past but fir and hardwood forest has partially re grown	Steelhead trout fingerlings and yearlings observed up to first barrier; A few resident trout up to 7 inches observed above the barrier	Small gravel beds common throughout first 3 miles; Pool: Riffle ratio 2:1; Shelter and nursery areas good due to deep pools, boulders and overhanging logs	37 logjams; Three barriers	Remove log jams; Manage for anadromous fish; Manage area above first three miles for resident trout if made accessible to fishermen
	BLM Survey	2/17/1972		Steelhead trout ranging from 2-6 inches observed from 0-5 per 100 ft of stream; Steelhead trout adults observed from 0-5 per 100 ft of stream	Good spawning gravel present		
	Coastal Headwaters Association Survey	1981-1983	Erosion evident at places		Spawning habitat limited by steep gradients and relatively few smaller gravels; Good fish rearing habitat		
	CDFG Electrofishing	5/25/1988		11 steelhead trout caught and 0 coho salmon caught in a 50 ft reach			
	CDFG Electrofishing	5/25/1988		2 steelhead trout caught and 19 coho salmon caught in a 100 ft reach			
	CDFG Electrofishing	8/4/1988		20 steelhead trout caught and 42 coho salmon caught in a 62 ft reach; The calculated density of steelhead trout was 0.22 fish/m^2 and coho salmon was 0.48 fish/m^2; The estimated population was 20±1.2 steelhead trout and 43±1.7 coho salmon (population estimates include 95% confidence intervals)			

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
North Fork Bear Creek (continued)	CDFG Electrofishing	8/2/1989		29 steelhead trout caught and 57 coho salmon caught in a 74 ft reach; The calculated density of steelhead trout was 0.33 fish/m^2 and coho salmon was 0.64 fish/m^2; The estimated population was 29 steelhead trout and 57 coho salmon			
	CDFG Electrofishing	8/14/1990		13 steelhead trout caught and 1 coho salmon caught in a 74 ft reach; The calculated density of steelhead trout was 0.15 fish/m^2; The estimated population was 13 steelhead trout			
South Fork Bear Creek	CDFG Survey	9/9/1966	Most of the watershed has been logged	Good numbers of salmonid fingerlings found to about the Shelter Cove Road, after that the numbers thinned down; At or near mouth, numbers estimated to be 200-300 per 100 ft of stream; Size of fish was 2-8 inches	Good beds of spawning gravel all along the stream and almost 100% gravel in the upper 1-2 miles; Pool: Riffle ratio 5:1; Shelter and nursery areas plentiful due to the bedrock and larger boulders	38 log jams, 2 culverts; No barriers	The log jams are not a hindrance to salmonids and more damage would be done in their removal than when they were gone; Some new logging shows are going on near the mouth and problems might develop there
	BLM Survey	2/18/1972	Parts of the watershed logged within the last 5 years	Many steelhead trout observed, sometimes at 6-50 per 100 ft of stream; 1 coho salmon carcass found	Good spawning gravels present		
	CDFG Field Note	6/21/1978		A fish population assessment by electrofishing found 224 steelhead trout in 2 150 ft sections			
	Letter from AE Naylor, CDFG, to Kirk Gothier, Humboldt County Planning Department concerning proposed development along the South Fork of Bear Creek	12/28/1979	We believe the proposed Athgarvan Enterprises, Inc. Subdivision in Shelter Cover (A.P. # 108-083-07;-084-07; -121-01) project will have significant adverse impact on the environment of the South Fork of Bear Creek as defined in the California Environmental Quality Act through diverting water directly from the creek and its feeder springs; Therefore, an Environmental Impact Report should be prepared				
	CDFG Field Note	2/4/1980				Inspection of log jams on BLM land for possible removal and increased access for spawning anadromous salmonids; 4 logjams noted; All of these jams recommended for removal to afford better fish passage and lessen bank erosion; High priority for restoration work	
	Coastal Headwaters Association Survey	1981-1983	Rehabilitation work expected to continue; A Chinook salmon hatchbox was installed in the upper stretch		A major spawning reach from Tolkan Campground to Horse Mt Campground; Extensively utilized rearing habitat upstream from there		Re-establishment of riparian vegetation is paramount along with intensive upslope stabilization in the more degraded areas;

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
South Fork Bear Creek (continued)	South Fork of Bear Creek Aquatic Habitat Management Plan by the BLM	5/1985	This management plan reviews the need and legislative basis for restoration of aquatic habitat in the South Fork of Bear Creek; The watershed is entirely within the boundaries of the King Range National Conservation Area; Past logging in the area has resulted in serious erosion, streambed silting and scouring, formation of debris jams, and loss of riparian vegetation Planned actions include: relocation of woody debris, revegetation by planting of riparian zone, reclamation and closure of abandoned roads, and salmon and steelhead trout information and education program				
	CDFG Field Note	8/24/1987		Three sections of the South Fork of Bear Creek were electrofished to locate potential release sites for pond-reared coho salmon; 174 young-of-the-year, 9 1+, 2 +2, and 1 +3 steelhead trout captured			
	CDFG Field Note	4/13/1988		Four sections of the South Fork of Bear Creek were electrofished to locate good and under utilized habitat for plants of coho salmon; 28 steelhead trout and 98 coho salmon captured			
	CDFG Electrofishing	8/12/1988		37 steelhead trout caught and 36 coho salmon caught in a 103.3 ft reach; The calculated density of steelhead trout was 0.53 fish/m^2 and coho salmon was 0.53 fish/m^2; The estimated population was 38±1.9 steelhead trout and 38±3.8 coho salmon (population estimates include 95% confidence intervals)			
	CDFG Electrofishing	8/2/1989		137 steelhead trout caught and 7 coho salmon caught in a 111.9 ft reach; The calculated density of steelhead trout was 1.8 fish/m^2 and coho salmon was 0.09 fish/m^2; The estimated population was 139 steelhead trout and 7 coho salmon			
	CDFG Electrofishing	8/14/1990		30 steelhead trout caught and 0 coho salmon caught in a 111.5 ft reach; The calculated density of steelhead trout was 0.33 fish/m^2; The estimated population was 30 steelhead trout			

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
South Fork Bear Creek (continued)	CDFG Electrofishing	8/20/1991		7 steelhead trout caught and 2 coho salmon caughtin a 11.5 ft reach; The calculated density of steelhead trout was 0.08 fish/m^2 and coho salmon was 0.02 fish/m^2; The estimated population was 2 steelhead trout and 2 coho salmon			
	CDFG Electrofishing	8/5/1992		72 steelhead trout caught and 0 coho salmon caught in a 111.5 ft reach; The calculated density of steelhead trout was 0.79 fish/m^2; The estimated population was 73 steelhead trout			
	CDFG Electrofishing	8/3/1993		116 steelhead trout caught and 0 coho salmon caught in a 111.5 ft reach; The calculated density of steelhead trout was 1.34 fish/m^2; The estimated population was 121 steelhead trout			
	CDFG Electrofishing	7/20/1995		43 steelhead trout caught and 0 coho salmon caught in a 122 ft reach; The calculated density of steelhead trout was 0.49 fish/m^2; The estimated population was 43 steelhead trout			
	CDFG Electrofishing	6/10/1997		55 steelhead trout caught and 24 coho salmon caught in a 204 ft reach; The calculated density of steelhead trout was 0.40 fish/m^2 and coho salmon was 0.40 fish/m^2; The estimated population was 56 steelhead trout and 24 coho salmon			
	CDFG Electrofishing	7/15/1998		17 steelhead trout caught and 0 coho salmon caught in a 98.4 ft reach			
	CDFG Electrofishing	9/17/1998		22 steelhead trout caught and 1 coho salmon caught in a 196.8 ft reach			
	CDFG Electrofishing	7/7/1999		34 steelhead trout caught and 0 coho salmon caught in a 100 ft reach			
	Welsh et. al 2001	2001	An MWAT of 53.6° F calculated. (In “Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California”)	Coho salmon found			
Little Finley Creek	CDFG Survey	9/8/1966		Salmonid fingerlings from 2-7 inches observed in the stream from mouth up to barrier	Good spawning gravel; Pool: Riffle ratio 3:1; Good shelter and nursery areas	22 logjams; 1 complete barrier	Remove logjams to make about 0.75 miles of good spawning grounds and nursery available
	BLM Survey	7/26/1972		Rainbow trout up to 8 inches seen at 0-5 per 100 ft of stream	Marginal spawning gravels present		

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Little Finley Creek (continued)	CDFG Survey	7/8/1981			Loose gravel present; Pool: Riffle ratio 1:10 near mouth and 1:3 near end of survey; High quality anadromous fish habitat	23 migration obstructions; 8 possible barriers and 9 probable barrier	Remove barriers
	Coastal Headwaters Association Survey	1981-1983	Entire drainage severely devastated by fire in September 1973; Major sediment contributor to the Mattole River	No fish seen		Tributaries clogged with logs and debris jams frequent on the mainstem; 1 shortly above the mouth strongly appears to be a complete blockage	Do not recommend removal of first jam; Strongly recommend extensive revegetation work
	Redwood Sciences Lab sampling	8/10/1995		0 coho salmon caught			
	Redwood Sciences Lab sampling	9/29/1995		0 coho salmon caught			
North Fork Little Finley Creek	BLM Survey	7/26/1972		Rainbow trout up to 4 inches long seen at 0-5 per 100 ft of stream in the lower section	Marginal spawning gravel present		
South Fork Little Finley Creek	BLM Survey	7/26/1972			Marginal spawning gravel present		
Big Finley Creek	CDFG Survey	9/7/1966		Salmonid fingerlings and yearlings common below the first log jam but few seen above this point	Streambed mostly rubble with about 1/4 mile of spawning gravel in small patches; Pool: Riffle ratio 1:6; Few shelter and nursery areas	8 logjams, 2 areas filled with slash	Remove of logjams and slash to allow water to wash out rubble and silt from slides
	BLM Survey	7/27/1972		Salmonids up to 10 inches in length see at 6-50 per 100 ft of stream near the mouth	Marginal spawning gravels present		
	Coastal Headwaters Association Survey	1981-1983	Watershed burned in September 1973 and salvage-logged; Extensive bank erosion	Fish that appeared to be steelhead trout or resident rainbow trout seen in January 1982	Habitat conditions are presently poor	Debris jams frequent	Seed red alder along the banks; Jam near mouth should not be removed as houses an otter family and removal would accelerate erosion;
	Redwood Sciences Lab sampling	9/19/1995		3 coho salmon caught			
	Welsh et. al 2001	2001	An MWAT of 60.8° F calculated. (In "Distribution of juvenile coho salmon in relation to water temperatures in tributaries of the Mattole River, California")	Coho salmon found			
North Fork Big Finley Creek	BLM Survey	7/27/1972		Rainbow trout up to 7 inches long seen at 0-5 per 100 ft of stream	Marginal spawning gravels present		
South Fork Big Finley Creek	BLM Survey	7/27/1972		Rainbow trout up to 3 inches long seen at 0-5 per 100 ft of stream	Marginal spawning gravels present		
Nooning Creek	CDFG Survey	9/7/1966		No fish observed	Contains rubble and gravel which is heavily silted in; Very few pools; Lacking in shelter and nursery areas	6 logjams; Log jam at mouth a complete barrier	Resurvey stream to see if logs and slash will be washed into the creek; Manage for anadromous fish
	BLM Survey	2/24/1972		No fish observed	Marginal spawning gravels present; Fish habitat poor		Block the road from future use and reseed it and disturbed areas to correct siltation problems; Remove debris develop pools

Tributary	Source	Date	General Comments	Fish Comments	Habitat Comments	Barrier Comments	Management Recommendations
Nooning Creek (continued)	CDFG Field Note	5/21/1974	A log bridge destroyed by fire and BLM plans to replace it with a steel bridge	Rainbow trout up to 7 inches were shocked and examined		A barrier at the mouth burned; A new barrier found 200 yards above the mouth	
	CDFG Field Note	6/29-30/1974	All riparian vegetation burned; Suggest to BLM that they replant willows and alders	Several 1 1/2-2 inch trout observed		Barriers removed from 3/4 mile of stream; The creek looks quite rough now but potential for improved steelhead trout access should overshadow temporary problems	
	CDFG Field Note	7/20/1977		6 inch salmonid observed near mouth of creek			
	CDFG Survey	4/22/1980	It appears that a fire swept through the area in 1973 and a salvage operation has left numerous skid trails on the banks	One adult salmonid 12 inches long observed approximately 300 ft above the mouth; Salmonids to 5" in length plentiful above barrier, suggesting a resident population	Spawning habitats plentiful; Pool: Riffle ratio 1:5; Rearing habitats plentiful	Many debris jams; 1 barrier	High priority for stream rehabilitation
	Coastal Headwaters Association Survey	1981-1983	Presently the subject of intensive study and rehabilitation work by BLM, HSU, and the CCC	Only a remnant run of steelhead trout presently utilize Nooning Creek for spawning			
	Research Proposal: Restoration of Rearing Habitat for Steelhead trout in Nooning Creek, Northern California; John B. Hamilton	1/9/1982	Study goal: determine whether current deflectors create additional habitat in Nooning Creek for yearling and older steelhead trout				

Instream Wood Removal Activities from1980 through 1992

In the late 1970s, a problem was perceived involving instream barriers to salmonid movement caused by timber harvest activities and flood events. This led to wood removal projects supervised by the CDFG in many California streams. The removal of in-stream large woody debris occurred in about 71 miles in the Mattole Basin during the 1980's (Table 38). A total of 56,960 cubic feet of wood was removed. This is equivalent to 445 logs 2 feet x 40 feet. This activity likely had adverse local impacts on salmonid habitat conditions. No wood was removed in the Estuary or Northern Subbasin; however, the amount of wood removed in the Eastern, Southern, and Western Subbasins was recorded.

A total of 1,024 cubic feet of wood was removed in the Eastern Subbasin (Table 39). This is equivalent to 8 logs 2 feet x 40 feet. In the Southern Subbasin, a total of 36,800 cubic feet of wood was removed (Table 40). This is equivalent to 294 logs 2 feet x 40 feet. Lastly, a total of 19,136 cubic feet of wood was removed in the Western Subbasin (Table 41). This is equivalent to 153 logs 2 feet x 40 feet.

Table 38. Wood Removal Totals 1980 through 1992 in the Mattole Basin.

Miles	Cubic Feet	Cords	Estimated Number 2' x 40' Logs
71.47	56960	445	445

Table 39. Wood Removal Totals 1980 through 1992 in the Eastern Subbasin.

Stream Name	Miles	Cubic Feet	Cords	Estimated Number 2' x 40' Logs
Mattole Canyon Creek	0.1	128	1	1
Eubank Creek	1.5	869	7	7
N = 2 **Total**	1.6	1024	8	8

Table 40. Wood Removal Totals 1980 through 1992 in the Southern Subbasin.

Stream Name	Miles	Cubic Feet	Cords	Estimated Number 2' x 40' Logs
Bridge Creek	1.25	768	6	6
South Fork Bridge Creek	1.0	1152	9	9
Vanauken Creek	4.63	8064	63	66
Harris Creek	1.75	2048	16	16
Stanley Creek	0.63	11904	93	95
Baker Creek	1.38	7744	60.5	62
Thompson Creek	3.75	2304	18	18
Mattole River	6.48	2816	22	23
N = 2 **Total**	20.87	36800	287.5	294

Table 41. Wood Removal Totals 1980 through 1992 in the Western Subbasin.

Stream Name	Miles	Cubic Feet	Cords	Estimated Number 2' x 40' Logs
Indian Creek	2.5	2048	16	16
Bear Creek	20.75	5120	40	41
South Fork Bear Creek	15.25	6900	75	77
Jewett Creek	6.0	1792	14	14
Nooning Creek	4.5	576	4.5	5
N = 2 **Total**	49	19136	149.5	153

Restoration Projects

Local watershed groups, the BLM, and various state agencies have worked on a number of habitat restoration projects throughout the Mattole Basin. The Mattole Restoration Council (MRC) and the Mattole Salmon Group (MSG) have obtained contracts for work on such diverse areas of restoration as road assessment, stream surveys, re-vegetation, instream structures, fish rearing, public education, and monitoring (Table 42).

Beginning in 1981, the Mattole Salmon Support Group (MSG) has trapped and raised native Chinook and coho salmon on a limited basis. In the upper reaches of the river system, the group has used hatch boxes placed instream to incubate fertilized eggs taken from locally trapped Chinook and coho broodstock. Presently, the Mattole Salmon Support Group is part of the CDFG Cooperative Trapping and Rearing Program. For the past several years in May and June, the group has also trapped Chinook out-migrants just upstream of the estuary / lagoon. Due to a combination of watershed factors, the estuary outlet closes in June or July in most years, preventing smolts from escaping very warm to lethal freshwater temperatures into the relative safety of the ocean. Project personnel and volunteers net up to 6,000 naturally spawned downstream Chinook migrants each year and then hold them in rearing ponds at Mill Creek (River Mile 2.8). Volunteers rear the fish until they are released to the estuary when river stream temperatures drop and/or the lagoon opens to the sea with fall rains. In the 14 years between 1981 and 1995, 338,000 Chinook salmon and 52,550 coho salmon have been released between the program's upstream and estuarine operations.

Table 42. Restoration projects in the Mattole Basin implemented by the Mattole Restoration Council (MRC) and the Mattole Salmon Group (MSG).

Project Proponent	Contact	Funding Agencies	Project Title	Start Date	End Date
Estuary Subbasin					
MSG	M. Evenson	CDFG	Lower Mattole Riparian Reforestation	4/28/96	4/15/97
MSG		CDFG	Mattole Estuary Enhancement-Log Structures	12/3/90	12/31/91
MSG		CDFG	Mattole Estuary Enhancement-Woody Debris, Shade Cover	12/3/90	12/31/91
MSG		CDFG	Mattole Estuary Enhancement-Willow Planting	12/3/90	12/31/91
MSG		BLM	Natural Resources of the Mattole River Estuary	3/88	
MSG			An Investigation of the Mattole River Estuary	4/84	3/85
MSG	D. Young		Juvenile Chinook Salmon Abundance, Growth, Production & Food Habits in the Mattole River Lagoon	1987	
MRC		Global ReLeaf/ National Fish and Wildlife Foundation	Willow planting by the Mattole Estuary	11/13-14/93	
MSG		BLM	Biological Parameters & Salmonid Populations, Emphasis on Steelhead, Mattole River Lagoon, California		1989
Northern Subbasin					
MRC	J. Morrison	CDFG /WCB	Mill Creek (R.M. 5.5) Habitat Enhancement	7/1/94	4/30/95
MRC		Eel River Sawmills	Monitoring on McGinnis Creek	7/1/93	4/1/94
Eastern Subbasin					
MSG	G. Peterson	DWR	Mid-Mattole Road Sediment Survey Inventory	11/1/01	11/1/03
MSG	G. Peterson	CDFG	Middle and Westlund Creek Channel Assessment	5/1/01	3/31/03
MSG	D. Simpson	Goldman	Westlund Creek Restoration Project	10/10/00	9/30/01
MSG		Sunlaw Cogeneration Partners I	Tree Planting Headwaters, Middle Creek.	2/23/96	
MRC	J. Morrison	CDFG	Mattole Canyon Habitat Enhancement	3/1/94	12/18/95
MRC		CDFG	Mattole Canyon Creek-Segment 0.5	c. 1992	c. 1994
MRC		CDFG	Mattole Canyon Creek-Segment 1.5	c. 1992	c. 1994
MRC		CDFG	Mattole Canyon Creek-Segment 2.5	c. 1992	c. 1994
MSG	D. Simpson		Eubank Creek Project	1984	1987
Southern Subbasin					
MSG	R. Lingel	CDFG	Thompson Creek, Phase 2	4/1/01	3/31/03?
MSG	G. Peterson	CDFG	2000 Large Woody Debris Upper Mattole River	6/1/00	3/31/02
MSG	G. Peterson	CDFG	Upper Mattole River Large Woody Debris	6/1/99	3/15/01
MSG	G. Peterson	CDFG	Upper Thompson Creek Sediment Reduction and Bank Stabilization Phase I	6/1/98	3/5/99

Project Proponent	Contact	Funding Agencies	Project Title	Start Date	End Date
MSG	G. Peterson	CDFG	Upper Mattole River Large Woody Debris project	3/1/98	9/99
MSG	G. Peterson	Humboldt County	Upper Mattole Salmon Restoration-Instream Woody Structure	7/10/96	10/96
MSG	D. Simpson	CDFG	Headwaters Habitat Improvement	4/8/96	11/15/97
MSG	R. Gienger/D. Simpson/ D. Brown	CDFG	Yew Creek Barrier Modification	10/15/93	10/15/94
MSG	R. Gienger	CDFG	Bridge Creek Restoration – Re-vegetation, Rock, Road erosion	12/15/92	12/30/94
MSG		CDFG	Bridge Creek Restoration	12/3/90	12/31/91
MSG		Coastal Headwaters Association	Upper Mattole Bank Stabilization	11/30/84	
Western Subbasin					
MSG	R. Yosha	BLM/MRC	South Fork Bear Creek	7/1/01	9/30/02
MSG	R. Yosha	BLM	South Fork Bear Creek Road Decommissioning	7/1/01	09//30/02
MSG	D. Simpson	CDFG	Green Fir Road	6/1/01	3/31/03
MSG	G. Peterson	CDFG	2000 Large Woody Debris Upper Bear Creek	6/1/00	3/31/02
MSG	G. Peterson	CDFG	Upper Bear Creek Large Woody Debris	6/1/99	3/15/01
MSG	M. Roche		Mill Creek (R.M. 2.8) Habitat Inventory Form	11/93	
MSG	G. Peterson	CDFG	Stansberry Creek Habitat Improvement	12/1/92	11/15/94
MSG	G. Peterson	CDFG	Mill Creek (R.M. 2.8) Cold Pool Enhancement	12/1/92	11/15/94
MSG	M. Roche	CDFG	Mill Creek (R.M. 2.8) Cool Water	1/1/92	11/15/92
MSG	M. Roche		Mill Creek (R.M. 2.8) Habitat Typing	8/19/9 1	
MSG	G. Peterson	CDFG	Culvert Improvement Project High Prairie Creek.	8/1/85	8/15/86
MSG			3,300 Yearling Coho Salmon Released into Mill Creek (R.M. 2.8)	1984	
MSG	F. House	California Coastal Conservancy/Redwood Community Action Agency	Mattole Watershed Atlas; Habitat Improvement Mill Creek (R.M. 2.8)	11/23/83	
MSG			10,000 Yearling Coho Salmon Released into Mill Creek (R.M. 2.8)	1983	
General Mattole Basin					
MSG	D. Simpson	CDFG	2001-2002 HB	6/1/01	12/15/02
MSG	R. Lingel	CDFG	Capacity Building	5/1/01	3/31/03
MSG	R. Lingel	CDFG	Classroom Incubators	4/1/01	3/31/03
MSG	G. Peterson	CDFG	Mattole Salmon Population Trend Monitoring	4/1/01	3/31/03
MSG		Mead Foundation	Restoration Work	1/9/01	
MSG	G. Peterson	BLM	Spawning surveys	2000	2001
MSG	L. Yonts/S. Zuckerman	USGS	Sediment Monitoring at Petrolia Bridge	11/1/00	?
MSG	D. Simpson	USGS/DWR	Sediment Sampling at Petrolia Bridge	10/23/00	4/30/01
MSG	D. Simpson	Goldman/Trees		10/10/00	?

Project Proponent	Contact	Funding Agencies	Project Title	Start Date	End Date
MSG	D. Simpson	BLM	2000/2001 Temperatures & Dives	10/1/00	7/30/01
MSG	G. Peterson	BLM	2000-2001 Spawning Surveys	10/1/00	7/30/01
MSG	G. Peterson	BLM	2000-2001 Downstream Migrant Trapping	10/1/00	7/30/01
MSG	R. Lingel	BLM	2000-2001 Macroinvertebrate Collection	10/1/00	7/30/01
MSG	R. Yosha	BLM	2000-2001 V-Star	10/1/00	7/30/01
MSG	R. Lingel	BLM	Spawning Surveys; Aquatic Macroinvertebrate Sampling; Downstream Migrant Trapping; Sediment Monitoring; Underwater Fish Counts	10/1/00	7/30/01
MSG	R. Yosha	BLM	King Range Road Drainage Improvement; Erosion Prevention	10/1/0 0	5/20/01
MSG	R. Yosha	CDFG	2000-2001 Monitoring	6/1/00	3/15/02
MSG	R. Yosha/R.Lingel	CDFG	2000-2001 Hatchbox Program	6/1/00	10/31/01
MSG			California Stream Bioassessment Worksheets for Citizen Monitors	1999	
MSG	G. Peterson	BLM	Spawning Surveys	1999	2000
MSG	D. Simpson	CDFG	Fish Rearing	9/1/99	1/23/01
MSG	G. Peterson	BLM	1999/2000 Downstream Migrant Trapping	8/25/99	9/30/00
MSG	G. Peterson	BLM	1999-2000 Spawning	8/25/99	9/30/00
MSG	R. Yosha	BLM	1999-2000 Macroinvertebrate Collection	8/25/99	9/30/00
MSG	R. Yosha	BLM	1999-2000 V-Star	8/25/99	9/30/00
MSG	M. Roche	CDFG	Fish Rearing	6/1/99	3/15/01
MSG	D. Simpson	CDFG	Hatchery Operations	4/1/99	7/20/00
MSG			California Stream Bioassessment Worksheets for Citizen Monitors	1998	
MSG			Downstream Migrant Trapping Field Notes	1998	
MSG	G. Peterson	BLM	Spawning Surveys	1998	1999
MSG	M. Coyne/D. Barber/M. Roche	CDFG	Mattole Ecological Education Project Classroom Aquarium	12/16/98	
MSG	M. Coyne/D. Barber/M. Roche	CDFG	Downstream Migrant Trapping	12/15/98	2/15/99
MSG	M. Roche/D. Simpson	CDFG	Fish Rearing	11/1/98	11/27/99
MSG	M. Roche/D. Simpson	BLM	Spawner surveys	11/1/98	11/27/99
MSG	M. Roche/D. Simpson	BLM	Downstream Migrant Trapping	11/1/98	11/27/99
MSG	M. Roche	BLM		8/25/98	9/30/99
MSG	G. Peterson	BLM/California Coastal Conservancy	Spawning Surveys	1997	1998
MSG	D. Wheeler/M. Roche	BLM	Aquatic Benthic Macroinvertebrate Monitoring Report	1997	
MSG	D. Barber/C. Trower	CDFG	Classroom Incubators	12/19/97	3/8/99
MSG	C. Coyne/M. Roche/D. Simpson	CDFG	Downstream Migrant Trapping	12/15/97	2/15/98
MSG	M. Roche/D. Simpson	CDFG	Fish Rearing	11/1/97	1/31/98
MSG	M. Roche/D. Simpson	BLM	Spawning Surveys; Downstream Migrant Trapping	11/1/97	1/31/98

Project Proponent	Contact	Funding Agencies	Project Title	Start Date	End Date
MSG	M. Roche/D. Simpson	Mead Foundation	Dive Surveys	11/1/97	1/31/98
MSG	M. Roche/D. Simpson	Mead Foundation	Classroom Aquarium	11/1/97	1/31/98
MSG	M. Roche	BLM	Salmonid Population	9/15/97	5/30/98
MSG	M. Roche	Redwood Community	Restoration Inventory and Monitoring #2	7/2/97	9/30/97
MSG	G. Peterson/M. Roche	CDFG	Fish Rearing	7/1/97	6/30/98
MSG	G. Peterson/M. Roche	CDFG	Fish Rearing	7/1/97	6/30/98
MSG			California Stream Bioassessment Worksheets for Citizen Monitors	1996	
MSG	G. Peterson	BLM/California Coastal Conservancy	Spawning Surveys	1996	1997
MSG	M. Roche	MSG	Water Temperatures	1996	
MSG	C. Coyne/M. Roche/D. Simpson	CDFG	Downstream Migrant Trapping	11/15/96	2/15/97
MSG	G. Peterson/M. Roche	CDFG	Fish Rearing	9/1/96	12/12/97
MSG	G. Peterson/M. Roche	California Coastal Conservancy	Spawning Surveys; Downstream Migrant Trapping	9/1/96	12/12/97
MSG	G. Peterson/M. Roche	Mead Foundation	Dive Surveys	9/1/96	12/12/97
MSG			Temperature Monitors	1995	1997
MSG	C. Coyne/M. Roche/D. Simpson	CDFG	Downstream Migrant Trapping	11/15/95	2/15/96
MSG	G. Peterson/M. Roche	CDFG	Fish Rearing	11/15/95	12/31/96
MSG	G. Peterson/M. Roche	Mead Foundation	Fish Rearing	11/15/95	12/31/96
MSG	M. Roche/D. Simpson	CDFG	Fish Rearing	11/15/95	12/31/96
MRC	J. Morrison	BLM	Herpetofauna Research	6/28/95	11/1/95
MRC	R. Stemler	CDFG	Enhancing the Investment?	2/1/95	4/30/96
MSG		Sunlaw Cogeneration Partners I	Tree Planting by Soilbankers	1/1/95	
MSG			Downstream Migrant Trapping Field Notes	1994	
MSG		Redwood Sciences Lab	Temperature Monitors	1994	
MSG	C. Coyne/M. Roche/D. Simpson	CDFG	Downstream Migrant Trapping	12/15/94	2/15/95
MRC	J. Morrison	BLM	Intermittent Stream Surveys	7/21/94	11/1/94
MSG	D. Simpson/G. Peterson	CDFG	Fish Rearing	7/1/94	6/30/95
MSG	D. Simpson/G. Peterson	Trout Unlimited	Fish Rearing	7/1/94	6/30/95
MRC	J. Morrison	Tides Foundation	Newsletter	4/7/94	
MSG		MSG	Temperature Monitors	1993	
MSG	C. Coyne/M. Roche/D.	CDFG	Downstream Migrant Trapping	11/15/93	2/15/94
MSG	D. Simpson/G. Peterson	CDFG	Fish Rearing	7/1/93	6/30/94
MSG	D. Simpson/G. Peterson	CDFG	Fish Rearing	7/1/93	6/30/94

Project Proponent	Contact	Funding Agencies	Project Title	Start Date	End Date
MSG	D. Simpson/G. Peterson	Trout Unlimited	Fish Rearing	7/1/93	6/30/94
MSG	M. Roche/D. Simpson	CDFG	Fish Rearing	7/1/93	12/12/93
MRC	R. Stemler	CDFG		6/15/93	
MSG			Downstream Migrant Trapping Field Notes	1992	
MSG	M. Roche/D. Simpson	CDFG	Fish Rearing	12/15/92	12/31/93
MSG	M. Roche/D. Simpson	CDFG	Fish Rearing	12/3/92	12/12/93
MRC	R. Stemler	CDFG		11/2/92	11/15/94
MSG	M. Roche		Habitat Typing	8/92	
MRC		Tides Foundation	Aerials, Maps, California Restoration Monitoring Project	7/1/92	
MSG	D. Simpson/G. Peterson	CDFG	Fish Rearing	7/1/92	6/30/93
MSG	D. Simpson/G. Peterson	CDFG	Fish Rearing	7/1/92	6/30/93
MSG	D. Simpson/G. Peterson	CDFG	Fish Rearing	7/1/92	6/30/93
MRC		Tides Foundation	Aerials, Surveys	6/25/92	7/10/92
MRC	F. House	J. Vance Huckins Fund		1/92	
MSG	D. Simpson/G. Peterson	CDFG	Downstream Migrant Trapping	11/15/91	2/15/92
MSG	D. Simpson/G. Peterson	CDFG	Fish Rearing	7/1/91	6/30/92
MSG	L. Preston	CDFG	A Cursory Evaluation of Salmonid Spawning and Rearing Conditions on the Mattole River	1990	
MSG	G. Peterson/D. Simpson	CDFG	Downstream Migrant Trapping	11/15/90	1/15/91
MSG	G. Peterson/D. Simpson	CDFG	Downstream Migrant Trapping	11/15/90	1/15/91
MSG		CDFG	Estuary #1 Final Report	8/90	Sep-90
MSG	D. Simpson/G. Peterson	CDFG	Fish Rearing	7/1/90	6/30/91
MSG	D. Simpson/G. Peterson	CDFG	Fish Rearing	7/1/90	6/30/91
MSG		CDFG	Fish Rearing	9/10/89	6/15/90
MRC	D. Simpson/S.	General Services	Forest Regeneration Study	1/31/89	5/3/89
MSG		USGS	Provisional Data	1988	1989
MSG		CDFG	Hatchbox Program	1988	1989
MSG	F. House	CDFG	Fish Rearing	9/12/88	6/18/89
MSG		CDFG	Hatchbox Program	1987	1988
MSG		CDFG	Hatchbox Program	1986	1987
MRC	C. Trower		Mattole Atlas	8/13/86	
MSG	G. Peterson		Mill Creek (R.M. 2.8) Restoration-Spawning Gravel Recruitment, Culvert Access and Improvement	7/86	8/86
MSG	F. House	CDFG	Fish Rearing	7/1/86	6/30/87
MSG			Chinook Salmon Populations and Related Biological Paramet ers	6/86	10/86
MSG	C. Arnold	California Coastal Conservancy	Mattole Watershed Enhancement Plan	1985	
MSG		CDFG	Hatchbox Program	1985	1986

Project Proponent	Contact	Funding Agencies	Project Title	Start Date	End Date
MSG		Humboldt State University California Cooperative Fishery Research Unit	Temperature Monitors	1985	1992
MSG	F. House	CDFG	Fish Rearing	7/1/85	6/30/86
MSG		California Coastal Conservancy	Mattole River Watershed Restoration: a Project by Coastal Headwaters Association with Redwood Community Action Agency	1983	1985
MSG	G. Peterson	MSG	3 Page Table of Recent Projects	1981	1997
MSG	J. Roscoe		The Mattole Valley Survival in a Rural Community	1977	
MSG		DWR	Water Management for Fishery Enhancement on North Coastal Streams	1974	
MSG		DWR	Character and Use of Rivers: Mattole River, a Pilot Study	1973	
MRC		Tides Foundation	Newsletter		
MRC		Tides Foundation	Sediment Monitoring		
MRC		Tides Foundation	THP Monitoring		
MRC		Tides Foundation	Training in Monitoring Techniques		
MRC		Tides Foundation	Database		
			Natural Resources & Habitat Inventory Summary Report		
MSG		Cereus Fund	2000-2001		
MSG		Cereus Fund	Fish Shop		
MSG	D. Simpson	Mendocino County	Lost River Crossing		
MSG		Trout Unlimited	Glantz		
MSG		CDFG	Headwaters Mattole Habitat Improvement		
MSG		CDFG	Juvenile Salmonids in Northern California Streams		

Stream Reach Attribute Table

Table 43. Mattole River Watershed Stream Reach Attribute Summary Table.

Stream	Reach	Reach Length	Channel Type	% of reach with Category 1 Embeddedness*	% of reach with Category 2 Embeddedness*	% Canopy Density	% Total pool habitat of survey length	% Pools >=3 ft deep of all pools measured	Mean Pool Shelter Rating
Northern Subbasin									
North Fork Mattole River	1	13720	C3	0	57	44	13	88	31
North Fork Mattole River	2	2047	B3	0	63	38	21	100	9
Sulphur Creek	1	7136	B4	30	45	72	12	14	39
Sulphur Creek Tributary #1	1	598	F4	0	67	87	12	0	3
Sulphur Creek Tributary #2	1	2632	B4	7	53	64	8	0	50
Conklin Creek	1	3163	C4	0	50	26	2	0	7
McGinnis Creek	1	16044	C4	0	11	61	5	8	55
McGinnis Creek	2	3456	B3	0	27	59	4	0	63
Oil Creek	1	1687	A1	7	7	14	60	41	33
Oil Creek	2	13014	B2	9	22	14	12	4	26
Oil Creek	3	1829	A2	0	40	30	10	0	38
Green Ridge Creek	1	3710	A2	9	27	21	10	0	28
Devils Creek	1	3885	B2	13	33	7	14	6	33
Devils Creek	2	2712	A3	0	71	10	16	0	37
Rattlesnake Creek	1	2421	B2	0	17	8	11	13	37
Rattlesnake Creek	2	7167	B1	0	27	10	29	45	14
Rattlesnake Creek	3	12515	A3	0	30	25	9	14	23
Eastern Subbasin									
Dry Creek	1	8548	F4	0	3	36	10	16	14
Middle Creek	1	7475	B4	0	0	52	10	3	12
Westlund Creek	1	12331	B4	0	32	85	13	7	16
Westlund Creek	2	4648	A4	0	67	78	3	25	23
Gilham Creek	1	9992	B4	2	31	73	13	5	33
Gilham Creek	2	3788	A2	0	13	71	6	0	14
Gilham Creek Tributary #1	1	3051	B4	0	40	74	5	0	27
Fourmile Creek	1	6948	C4	3	20	43	18	33	16
Fourmile Creek	2	8618	F4	0	26	61	12	10	28
North Fork Fourmile Creek	1	0	C4	0	0	46	6	0	15
North Fork Fourmile Creek	2	3490	A4	0	22	51	11	4	23
Sholes Creek	1	21147	B4	0	24	78	22	20	39
Harrow Creek	1	1222	B3	13	7	99	30	7	35
Little Grindstone Creek	1	2991	B4	7	43	88	6	0	20
Grindstone Creek	1	13772	B4	0	21	51	12	18	18
Blue Slide Creek	1	33416	F4	0	23	46	22	39	23
Fire Creek	1	10723	F4	0	3	67	6	3	31
Box Canyon Creek	1	777	F4	43	14	46	15	13	13
Box Canyon Creek	2	1208	B4	13	13	62	11	0	50
Box Canyon Creek	3	791	B2	38	25	66	16	25	10
Eubank Creek	1	15895	B1	0	43	78	33	20	58
Eubank Creek	2	1661	B4	0	0	86	34	17	40
McKee Creek	1	3814	B3	31	50	80	38	11	23
McKee Creek	2	7965	F4	11	62	87	25	3	34
Unnamed Tributary to McKee Creek	1	397		0	80	79	13	0	16
Painter Creek	1	1616	F4	20	70	71	20	0	21
Southern Subbasin									
Unnamed Tributary to Mattole River	1	909		0	20	93	21	20	130
Bridge Creek	1	3951	F4	0	50	76	37	85	65
Bridge Creek	2	2500	No Access	0	0	0	0	0	0
Bridge Creek	3	10016	F4	0	11	93	24	13	52
West Fork Bridge Creek	1	4667	B4	0	0	76	19	13	55

Stream	Reach	Reach Length	Channel Type	% of reach with Category 1 Embeddedness*	% of reach with Category 2 Embeddedness*	% Canopy Density	% Total pool habitat of survey length	% Pools >=3 ft deep of all pools measured	Mean Pool Shelter Rating
West Fork Bridge Creek	2	2719	C4	0	0	78	23	0	10
South Branch of West Fork Bridge Creek	1	7456	F4	0	13	73	18	10	58
Vanauken Creek	1	7456	F4	5	19	92	35	12	64
Vanauken Creek	2	579	G4	0	17	0	25	33	23
South Fork Vanauken Creek	1	449		0	0	90	35	29	79
Anderson Creek	1	5012	B3	0	2	88	10	14	19
Mill Creek (R.M. 56.2)	1	934	F4	0	67	95	45	57	50
Upper Mattole River	1	35199	F3	0	41	83	43	61	100
Stanley Creek	1	5076	F4	6	43	94	32	24	16
Baker Creek	1	11852	F4	39	48	99	26	2	68
Thompson Creek	1	8257	B1	0	56	83	39	57	36
Thompson Creek	2	9080	F1	0	14	91	40	24	47
Yew Creek	1	3444	B4	0	22	78	0	0	64
Helen Barnum Creek	1	5012	E4	17	72	61	11	9	60
Lost Man Creek	1	6112	E4	14	83	81	17	19	32
Lost Man Creek Tributary #1	1	6558	E4	39	31	83	44	14	45
Western Subbasin									
Mill Creek (R.M. 2.8)	1	5805	B2	1	51	82	24	10	40
Mill Creek (RM 2.8) Tributary #1	1	808	A2	0	71	80	12	0	42
Mill Creek (RM 2.8) Tributary #2	1	175	A2	33	33	83	26	0	5
Squaw Creek	1	22443	F3	0	19	0	20	0	42
Woods Creek	1	6415	F4	0	73	60	5	13	48
Woods Creek	2	3478	B4	0	13	72	5	22	60
Honeydew Creek	1	7575	F4	0	27	29	24	91	51
Honeydew Creek	2	1425	F4	No Access					
Honeydew Creek	3	4505	F4	0	33	48	19	89	61
Honeydew Creek	4	5877	F3	0	17	77	14	77	92
Honeydew Creek	5	3796	A2	0	17	64	10	38	63
Bear Trap Creek	1	9883	B2	0	8	66	16	7	71
Upper North Fork Honeydew Creek	1	5514	F2	0	0	76	15	37	57
East Fork Honeydew Creek	1	15231	F2	0	28	69	20	29	66
West Fork Honeydew Creek	1	3897	B2	0	94	75	12	38	83
Bear Creek	1	15114	F3	43	41	44	31	92	85
Bear Creek	2	9017	F2	74	4	44	27	76	90
Bear Creek	3	8437	B2	45	29	51	39	84	78
Bear Creek	4	5606	F2	40	7	42	28	80	78
Jewett Creek	1	14415	F4	1	4	90	16	6	47
North Fork Bear Creek	1	13152	B4	29	32	50	11	60	43
North Fork Bear Creek	2	4622	A3	42	47	76	22	64	48
North Fork Bear Creek Tributary #1	1	7651	B5	24	64	57	26	13	34
North Fork Bear Creek Tributary #1	2	1601	A2	20	60	59	57	7	17
South Fork Bear Creek	1	9780	B2	33	57	62	38	47	48
South Fork Bear Creek	2	24114	F3	36	34	85	27	28	32
South Fork Bear Creek	3	27869	B3	7	11	93	29	9	45
South Fork Bear Creek	4	1392	F4	0	0	96	9	0	30
Big Finley Creek	1	6772	B4	0	53	86	19	21	33
Big Finley Creek	2	1725	A2	0	71	83	11	0	20
South Fork of Big Finley Creek	1	6654	B3	0	40	61	9	9	26
Nooning Creek	1	301	F3	0	0	93	33	20	70
Nooning Creek	2	7647	B2	6	19	83	17	8	62

* "Cobble embeddedness" is the % of an average sized cobble piece at a pool tail out that is embedded in fine substrate. 0-25% embedded = Category 1 Embeddedness, 26-50% embedded = Category 2 Embeddedness. Reaches with cobble embeddedness greater than 51% are not within the suitable range for successful use by salmonids.

Habitat Histograms

The California Department of Fish and Game (CDFG) inventoried 61 tributaries to the Mattole River and the headwaters of the Mattole from 1991 to 2002. The tributaries and the headwaters were composed of 97 stream reaches, defined as Rosgen channel types. CDFG created histograms of several kinds habitat data collected during stream inventories. A histogram is a bar chart representing a frequency distribution; the heights of the bars represent the number of stream reaches measured to be within each category or bin. The cumulative percentage of stream reaches within each category was also calculated. Histograms were created for percent canopy density, percent category 1 and 2 embeddedness, percent pools by stream length, pool depth, pool shelter ratings, and percent occurrence of large organic debris.

Canopy cover was measured at each habitat unit during CDFG stream surveys. Near-stream forest density and composition contribute to microclimate conditions that help regulate air temperature, which is an important factor in determining stream water temperature. Furthermore, canopy levels provide an indication of the potential present and future recruitment of large woody debris to the stream channel, as well as the insulating capacity of the stream and riparian areas during winter. More than half of the surveyed stream reaches in the Mattole Basin had a percent canopy density greater than 70% (Figure 15). There were more stream reaches with percent canopy densities between 80 and 90 % than any other category.

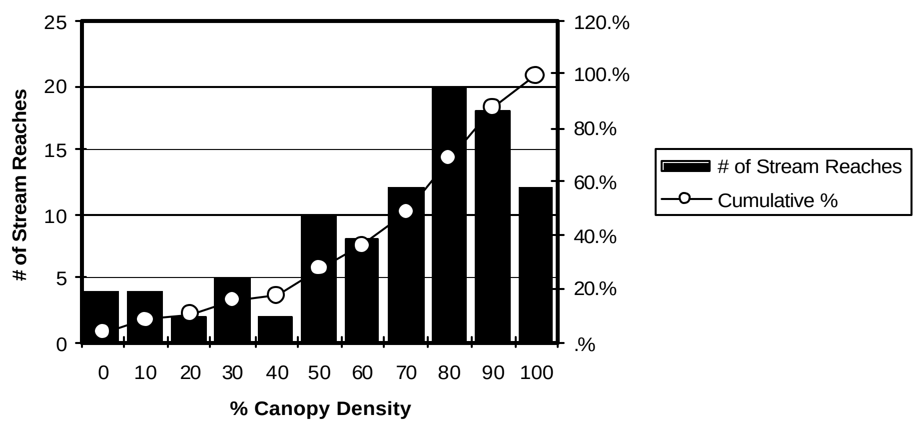


Figure 15. Histogram of the percent canopy density of surveyed stream reaches in the Mattole Basin.

Cobble embeddedness was measured at each pool tail crest during CDFG stream surveys. Cobble embeddedness is the percentage of an average sized cobble piece at a pool tail out that is embedded in fine substrate. Category 1 is 0-25% embedded, Category 2 is 26-50% embedded, Category 3 is 51-75% embedded, Category 4 is 76-100% embedded, and Category 5 is unsuitable for spawning due to factors other than embeddedness, such as a bedrock or log sill as a pool tail crest. Cobble embedded in excess of 50% is not within the fully supported range for successful use by salmonids. Less than forty percent of the surveyed stream reaches in the Mattole Basin had cobble embeddedness within the fully supported range for successful use by salmonids in more than 50% of the reach surveyed (Figure 16).

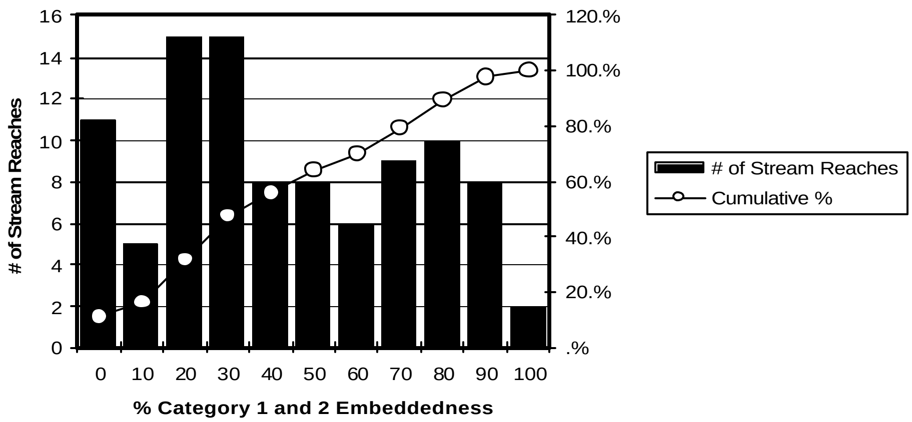


Figure 16. Histogram of the percent category 1 and 2 embeddedness of surveyed stream reaches in the Mattole Basin.

Pool, flatwater, and riffle habitat units observed were measured, described, and recorded during CDFG stream surveys. The percentage of pool habitat by stream length, and the mean pool depth were calculated for each stream reach. During their life history, salmonids require access to pools, flatwater, and riffles. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. Primary pools are determined by a range of pool depths, depending on the order (size) of the stream. In first and second order streams, a primary pool is defined to have a maximum depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. More than half of the surveyed stream reaches in the Mattole Basin had a percent total pool habitat by length less than 30% (Figure 17). There were more stream reaches with percent pools by stream length between 20 and 30 % than any other category. More than half of the surveyed stream reaches also had a mean pool depth of less than two feet (Figure 18), though there were more stream reaches with mean pool depths between two and three feet than any other category.

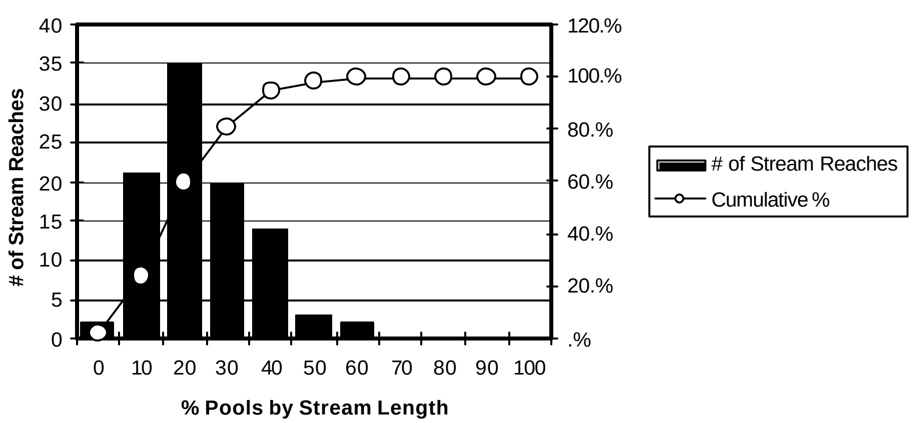


Figure 17. Histogram of the percent pools by stream length of surveyed stream reaches in the Mattole Basin.

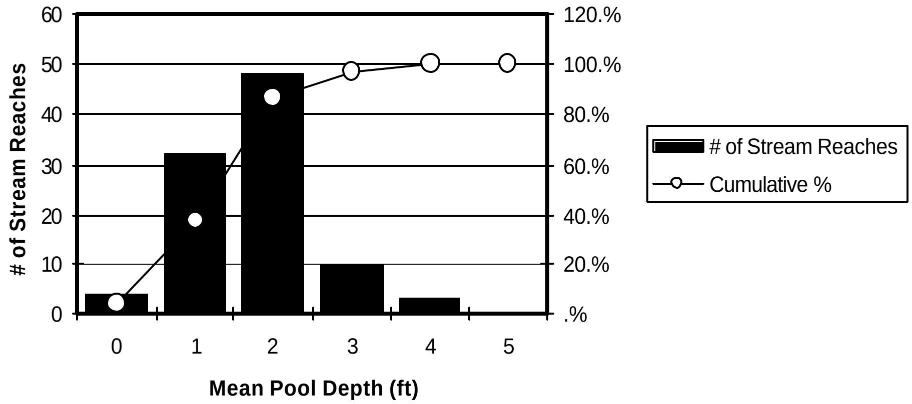


Figure 18. Histogram of mean pool depth of surveyed stream reaches in the Mattole Basin.

Pool shelter was measured during CDFG surveys. Pool shelter ratings illustrate relative pool complexity, another component of pool quality. Ratings range from 0-300. The Stream Reach EMDS model evaluates pool shelter to be fully unsuitable if less than a rating of 30. The range from 100 to 300 is fully suitable. More than half of the surveyed stream reaches had a pool shelter rating of less than 50 (Figure 19). There were more stream reaches with pool shelter ratings between 40 and 50 than any other category.

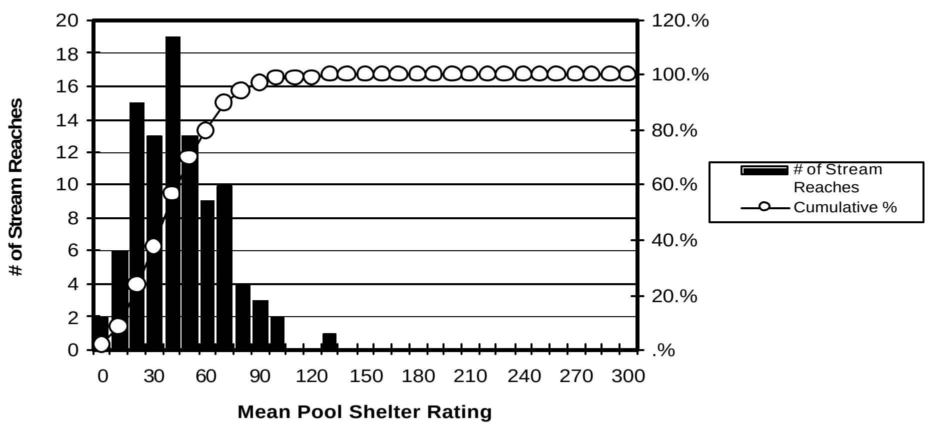


Figure 19. Histogram of pool shelter ratings of surveyed stream reaches in the Mattole Basin.

The percentage of shelter provided by various structures (i.e. undercut banks, woody debris, root masses, terrestrial vegetation, aquatic vegetation, bubble curtains, boulders, or bedrock ledges) is described in CDFG surveys. The dominant shelter type is elucidated and then the percentage of a stream reach in which the dominant shelter type is provided by organic debris is calculated. More than half of the surveyed stream reaches had a percent occurrence of large organic debris of less than 20% (Figure 20). There were more stream reaches with a percent occurrence of large organic debris between 10 and 20% than any other category.

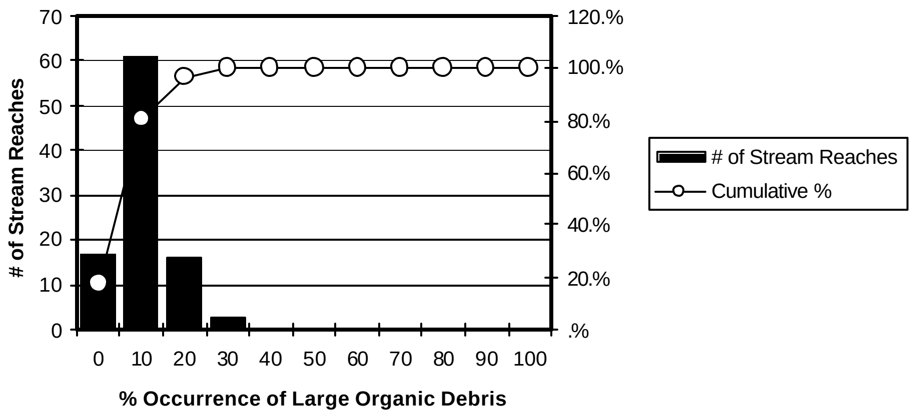


Figure 20. Histogram of the percent of large organic debris occurrence of surveyed stream reaches in the Mattole Basin

Condensed Tributary Reports

Northern Subbasin

North Fork Mattole River

North Fork Mattole River is tributary to the Mattole River, located in Humboldt County, California. North Fork Mattole River 's legal description at the confluence with the Mattole River is T02S R02W S04. Its location is 40°19′05″ north latitude and 124°17′27″ west longitude. North Fork Mattole River is a third order stream and has approximately 13.3 miles of blue line stream according to the USGS Petrolia, Buckeye Mountain, and Taylor Peak 7.5 minute quadrangles. North Fork Mattole River drains a watershed of approximately 36.5 square miles. Elevations range from about 65 feet at the mouth of the creek to 2920 feet in the headwater areas. Douglas fir, mixed conifer forest, and grasslands dominate the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists via the Mattole Road. From Ferndale to Petrolia, the road crosses North Fork Mattole River less than a mile before Petrolia. Walk downstream to the mouth of North Fork Mattole River.

The habitat inventory of July 12 and 13, 2002, was conducted by Dave Kajtaniak and Ruth Goodfield (PSMFC, CDFG). The total length of the stream surveyed was 15,767 feet with an additional 2,146 feet of side channel. North Fork Mattole River is a C3 channel type for the first 13.720 feet of stream reach surveyed, and a B3 channel type for the remaining 2,047 feet. C3 channels are slightly entrenched, meandering, riffle/pool channels on <2% gradients with moderate to high width/depth ratios and cobble-dominant substrates. B3 channels are moderately entrenched, meandering, riffle/pool channels on 2-4% gradients with moderate width/depth ratios and cobble-dominant substrates.

Location of Stream Mouth:		
Survey Dates: 7/11/2002 through 7/12/2002		
USGS Quad Map: Petrolia	Latitude: 40º 19' 5"	Longitude: 124º 17' 27"
Stream Reach: 1		
Channel Type: C3		Canopy Density: 44%
Bankfull Width: 60 ft		Coniferous Component: 0%
Channel Length: 13720 ft		Deciduous Component: 100%

Riffle/Flatwater Mean Width: 29 ft	Pools by Stream Length: 13%
Total Pool Mean Depth: 2.3 ft	Pools >= 3 ft Depth: 88%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 31
Water Temperature: 67-82°F	Dominant Shelter: Boulders
Air Temperature: 57-81°F	Occurrence of Large Organic Debris: 1%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 53%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 57% 3: 43% 4: 0% 5: 0%	
Stream Reach: 2	
Channel Type: B3	Canopy Density: 33%
Bankfull Width: 77 ft	Coniferous Component: 19%
Channel Length: 2047 ft	Deciduous Component: 81%
Riffle/Flatwater Mean Width: 30 ft	Pools by Stream Length: 21%
Total Pool Mean Depth: 3.7 ft	Pools >= 3 ft Depth: 100%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 9
Water Temperature: 67-67°F	Dominant Shelter: Bedrock Ledges
Air Temperature: 65-67°F	Occurrence of Large Organic Debris: 0%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 64%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 63% 3: 38% 4: 0% 5: 0%	

No sites were electrofished on July 11 and 12, 2002, in North Fork Mattole River. Juvenile salmonids were observed by the surveyors throughout the length of stream surveyed.

Sulphur Creek

Sulphur Creek is a tributary to the East Branch of the North Fork of the Mattole River, tributary to the North Fork of the Mattole River, tributary to the Mattole River, located in Humboldt County, California. Sulphur Creek's legal description at the confluence with East Branch N. F. Mattole River is T01S R01W S27. Its location is 40°20′49.2″ north latitude and 124°10′16.8″ west longitude. Sulphur Creek is a third order stream and has approximately 6.8 miles of blue line stream according to the USGS Buckeye Mt. 7.5 minute quadrangle. Sulphur Creek drains a watershed of approximately 3.8 square miles. Elevations range from about 1080 feet at the mouth of the creek to 2800 feet in the headwater areas. Douglas fir and mixed conifer forest dominate the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists from Monument Ridge on a private road controlled by Pacific Lumber Company, across Bear River Bridge near Beer Bottle Creek. Continue for eight miles to trailhead. From the trailhead hike approximately a half mile to the confluence of Sulphur Creek and the East Branch of the North Fork of the Mattole River.

The habitat inventory of June 29, and 30, 1999, was conducted by Donn Rehburg and Michelle Anderson (WSP/AmeriCorps). The total length of the stream surveyed was 7,137 feet with an additional 701 feet of side channel.

Sulphur Creek is a B4 channel type for the entire 7,136 feet of stream reach surveyed. B4 channel types are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools; very stable plan and profile; stable banks; gravel channel. The suitability of B4 channel types for fish habitat improvement structures are excellent for low-stage plunge weirs; boulder clusters; bank placed boulders; single and opposing wing-deflectors; log cover.

Survey Data:

Location of Stream Mouth:
Survey Dates: 6/29/99 through 6/30/99
USGS Quad Map: Buckeye Mountain Latitude: 40º 20' 49" Longitude: 124º 10' 17"

Stream Reach: 1	
Channel Type: B4	Canopy Density: 72%
Bankfull Width: 21.5 ft	Coniferous Component: 54%
Channel Length:7136 ft	Deciduous Component: 46%
Riffle/Flatwater Mean Width: 11 ft	Pools by Stream Length: 12%
Total Pool Mean Depth: 2.4 ft	Pools >= 3 ft Depth: 14%
Base Flow: 2.1 cfs	Mean Pool Shelter Rating: 39
Water Temperature: 56-67ºF	Dominant Shelter: Boulders
Air Temperature: 64-85ºF	Occurrence of Large Organic Debris: 5%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 66%	
Dominant Bank Substrate: Cobble/Gravel	

Embeddedness Value: 1: 30% 2: 45% 3: 13% 4: 0% 5: 13%

No biological sampling was conducted on Sulphur Creek.

Sulphur Creek Tributary #1

Unnamed Tributary #1 to Sulphur Creek is a tributary to the Sulphur Creek, tributary to the East Branch of the North Fork of the Mattole River, tributary to the North Fork Mattole River, tributary to Mattole River, located in Humboldt County, California (Map 1). Unnamed Tributary #1 to Sulphur Creek's legal description at the confluence with Sulphur Creek is T01S R01W S27. Its location is 40°20′59.5″ north latitude and 124°09′58″ west longitude. Unnamed Tributary #1 to Sulphur Creek is a first order stream and has approximately 0.9 miles of blue line stream according to the USGS Buckeye Mt. 7.5 minute quadrangle. Unnamed Tributary #1 to Sulphur Creek drains a watershed of approximately 0.54 square miles. Elevations range from about 1145 feet at the mouth of the creek to 1680 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for timber production. See Sulphur Creek for vehicle access directions.

The habitat inventory of July 8, 1999, was conducted by Donn Rehberg (AmeriCorps/WSP). The total length of the stream surveyed was 598 feet.

Unnamed Tributary #1 to Sulphur Creek is an F4 channel type for the entire 598 feet of stream reach surveyed. F4 channel types are entrenched meandering riffle/pool channel on low gradients with high width/depth ratio and a gravel channel. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors and log cover.

Survey Data:

Location of Stream Mouth:
Survey Dates: 8/17/98 through 8/18/98
USGS Quad Map: Buckeye Mountain Latitude: 40º 20' 59" Longitude: 124º 9' 58"

Stream Reach: 1	
Channel Type: F4	Canopy Density: 87%
Bankfull Width: ft	Coniferous Component: 16%
Channel Length:598 ft	Deciduous Component: 85%
Riffle/Flatwater Mean Width: 6 ft	Pools by Stream Length: 12%
Total Pool Mean Depth: 1 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 3
Water Temperature: 58-61ºF	Dominant Shelter: Boulders
Air Temperature: 70-76ºF	Occurrence of Large Organic Debris: 0%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 89%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 67% 3: 0% 4: 0% 5: 33%	

No biological sampling was conducted on unnamed tributary #1 to Sulphur Creek.

Sulphur Creek Tributary #2

Unnamed Tributary #2 to Sulphur Creek is a tributary to Sulphur Creek, tributary to the Mattole River, located in Humboldt County, California. Unnamed Tributary #2 to Sulphur Creek's legal description at the confluence with Sulphur Creek is T01S R01W S27. Its location is 40°21′11.5″ north latitude and 124°09′50″ west longitude. Unnamed Tributary #2 to Sulphur Creek is a first order stream and has approximately 1.2 miles of blue line stream according to the USGS Buckeye Mt. 7.5 minute quadrangle. Unnamed Tributary #2 to Sulphur Creek drains a watershed of approximately 0.85 square miles. Elevations range from about 1190 feet at the mouth of the creek to 2120 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for timber production. See Sulphur Creek report for vehicle access directions.

The habitat inventory of July 08, 1999, was conducted by Donn Rehburg and Michelle Anderson (AmeriCorps/WSP). The total length of the stream surveyed was 2,632 feet with an additional 23 feet of side channel.

Unnamed Tributary #2 to Sulphur Creek is a B4 channel type for the entire 2,632' of stream reach surveyed. B4 channel types are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools; very stable plan and profile; stable banks; gravel channel. The suitability of B4 channel types for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors and log cover.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/7/99 through 7/7/99
USGS Quad Map: Buckeye Mountain Latitude: 40º 21' 12" Longitude: 124º 9' 50"

Stream Reach: 1	
Channel Type: B4	Canopy Density: 64%
Bankfull Width: 16.4 ft	Coniferous Component: 44%
Channel Length: 2632 ft	Deciduous Component: 56%
Riffle/Flatwater Mean Width: 8 ft	Pools by Stream Length: 8%
Total Pool Mean Depth: 1.1 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0.3 cfs	Mean Pool Shelter Rating: 50
Water Temperature: 63-63ºF	Dominant Shelter: Boulders
Air Temperature: 57-65ºF	Occurrence of Large Organic Debris: 3%
Dominant Bank Vegetation: Coniferous Trees	Dry Channel: 0 ft
Vegetative Cover: 75%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 7% 2: 53% 3: 27% 4: 0% 5: 13%	

No biological sampling was conducted on unnamed tributary #2 to Sulphur Creek.

Conklin Creek

Conklin Creek is tributary to the Mattole River, tributary to the Pacific Ocean, located in Humboldt County, California. Conklin Creek's legal description at the confluence with Mattole River is T02S R02W S12. Its location is 40°18′32″ north latitude and 124°14′10″ west longitude. Conklin Creek is a third order stream and has approximately 8.6 miles of blue line stream according to the USGS Buckeye Mountain 7.5 minute quadrangle. Conklin Creek drains a watershed of approximately 5.4 square miles. Elevations range from about 40 feet at the mouth of the creek to 2,200 feet in the headwater areas. Douglas fir forest and oak grassland dominate the watershed. The watershed is primarily privately owned and is managed for timber production and rangeland. Vehicle access exists via the Mattole Road from Ferndale to Petrolia, turn left before the Mattole River bridge at the Hideway Restaurant onto the Conklin Creek Road. Travel along the Conklin Creek Road approximately 3 miles until you reach Conklin Creek.

The habitat inventory of August 5, 1999, was conducted by Paul Ferns and Donn Rehburg (AmeriCorps/WSP). The total length of the stream surveyed was 3,163 feet with an additional 33 feet of side channel.

Conklin Creek is a C4 channel type for the entire 3,163 feet of stream reach surveyed. C4 channel types are low gradient, meandering, point-bar, riffle/pool gravel alluvial channels with broad, well defined floodplains. The suitability of C4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover.

Survey Data:

Location of Stream Mouth:
Survey Dates: 8/5/99 through 8/5/99
USGS Quad Map: Buckeye Mountain Latitude: 40º 18' 32" Longitude: 124º 14' 10"

Stream Reach: 1	
Channel Type: C4	Canopy Density: 26%
Bankfull Width: 17.4 ft	Coniferous Component: 4%

Channel Length:3163 ft	Deciduous Component: 96%
Riffle/Flatwater Mean Width: 10 ft	Pools by Stream Length: 2%
Total Pool Mean Depth: 1 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 7
Water Temperature: 63-63ºF	Dominant Shelter: Small Woody Debris
Air Temperature: 65-66ºF	Occurrence of Large Organic Debris: 1%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 22 ft
Vegetative Cover: 42%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 50% 3: 0% 4: 0% 5: 50%	

One site was electrofished on September 29, 1999 in Conklin Creek. The sites were sampled by Glenn Yoshioka, Paul Ferns. and Donn Rehberg (CCDFG and AmeriCorps/WSP). The site sampled began at the confluence with the Mattole River and included six mid-channel pools, one low gradient riffle, and one run within the first 3,200 feet above the confluence. The site yielded: 342 steelhead rainbow trout. Based upon visually estimated lengths, the probable breakdown of steelhead age classes was 330 age 0+, 6 age 1+, and 6 age 2+ juveniles.

McGinnis Creek

McGinnis Creek is tributary to the Mattole River, tributary to the Pacific Ocean, located in Humboldt County, California. McGinnis Creek's legal description at the confluence with Mattole River is T02S R02W S12. Its location is 40°18′22″ north latitude and 124°14′13″ west longitude. McGinnis Creek is a second order stream and has approximately 9.0 miles of blue line stream according to the USGS Buckeye Mountain 7.5 minute quadrangle. McGinnis Creek drains a watershed of approximately 6.0 square miles. Elevations range from about 80 feet at the mouth of the creek to 2,200 feet in the headwater areas. Douglas fir forest and oak grassland dominate the watershed. The watershed is primarily privately owned and is managed for timber production and rangeland. Vehicle access exists via the Mattole Road from Ferndale to Petrolia, turn left before the Mattole River bridge at the Hideway Restaurant onto the Conklin Creek Road. Travel along the Conklin Creek Road approximately 3 miles until you reach McGinnis Creek.

The habitat inventory of July 27, 1999 to August 4, 1999, was conducted by Greg Larsen and Michelle Anderson (AmeriCorps/WSP). The total length of the stream surveyed was 16,044 feet with no additional feet of side channel.

McGinnis Creek is a C4 channel type for the entire 16,044 feet of stream reach surveyed. C4 channel types are low gradient, meandering, point-bar, riffle/pool gravel alluvial channels with broad, well defined floodplains. The suitability of C4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover.

Location of Stream Mouth:	
Survey Dates: 7/27/1999 through 8/4/1999	
USGS Quad Map: Buckeye Mountain Latitude: 40º 18' 22" Longitude: 124º 14' 13"	
Stream Reach: 1	
Channel Type: C4	Canopy Density: 61%
Bankfull Width: 18.7 ft	Coniferous Component: 12%
Channel Length:16044 ft	Deciduous Component: 88%

Riffle/Flatwater Mean Width: 14 ft	Pools by Stream Length: 5%
Total Pool Mean Depth: 1.3 ft	Pools >= 3 ft Depth: 8%
Base Flow: 0 cfs	Mean Pool Shelter Rating:55
Water Temperature: 73-73°F	Dominant Shelter: Boulders
Air Temperature: 72-72°F	Occurrence of Large Organic Debris: 15%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 78%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 11% 3: 37% 4: 40% 5: 11%	
Stream Reach: 2	
Channel Type: B3	Canopy Density: 59%
Bankfull Width: 22.7 ft	Coniferous Component: 28%
Channel Length:3456 ft	Deciduous Component: 72%
Riffle/Flatwater Mean Width: 8 ft	Pools by Stream Length: 4%
Total Pool Mean Depth: 1.4 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0 cfs	Mean Pool Shelter Rating:63
Water Temperature: 58-64°F	Dominant Shelter: Boulders
Air Temperature: 60-70°F	Occurrence of Large Organic Debris: 8%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 63%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 27% 3: 64% 4: 0% 5: 9%	

Biological sampling was not conducted in McGinnis Creek, however YOY salmonids were observed from the streambanks throughout the survey.

Oil Creek

Oil Creek is a tributary to the Upper North Fork Mattole River, a tributary to the Mattole River, located in Humboldt County, California (Figure 1). Oil Creek's legal description at the confluence with the Upper North Fork Mattole River is T2S R1E S19. Its location is 40N17'27" latitude and 124N06'36" longitude. Oil Creek is a third order stream. The total length of blue line stream, according to the USGS Bull Creek and Buckeye Mountain quadrangles is 3.6 miles. Oil Creek drains a watershed of approximately 9.4 square miles. Douglas fir forest and oak grassland dominate the watershed. The watershed is privately owned and is managed for timber production and cattle grazing. In the summer of 1991, a timber harvest plan was carried out in this watershed. This was in response to portions of the left bank of the headwaters being subjected to extensive forest fires in the summer of 1990. The road system in this watershed was upgraded under the Department of Fish and Game and the Department of Forestry. This was due to anticipated and projected sediment yield increases from burned areas of the watershed. Vehicle access exists from U.S. Highway 101, via the Bull Creek/Mattole Road.

The habitat inventory of August 5, 6, 7, and 14, 1991, was conducted by Shea Monroe and Brian Humphrey (CCC). The total length of stream surveyed was 16,574 feet, with an additional 773 feet of side channel. This section of Oil Creek has three channel types: from the mouth to 1,687 an A1; next 13,014 feet a B2; and the upper next 1829 feet an A2. A1 channels are steep (4-10% gradient), very well confined streams, with bedrock dominated substrate. B2 channels are moderate gradient (1.0-2.5%), moderately confined, with stable streambanks and boulder dominated substrate. A2 channels are steep, very well confined boulder channels.

Survey Data:

Location of Stream Mouth:
Survey Dates: 8/5/91 through 8/14/91
USGS Quad Map: Bull Creek / Buckeye Latitude: 40º 17' 27" Longitude: 124º 6' 36"

Stream Reach: 1
Channel Type: A1
Bankfull Width: ft
Channel Length: 1687 ft
Riffle/Flatwater Mean Width: 13 ft
Total Pool Mean Depth: 1.9 ft
Base Flow: 0 cfs
Water Temperature: 61-69°F
Air Temperature: 64-75°F
Dominant Bank Vegetation: Grass
Vegetative Cover: 51%
Dominant Bank Substrate: Bedrock
Embeddedness Value: 1: 7% 2: 7% 3: 33% 4: 53% 5: 0%

Canopy Density: 14%
Coniferous Component: 31%
Deciduous Component: 69%
Pools by Stream Length: 60%
Pools >= 3 ft Depth: 41%
Mean Pool Shelter Rating: 33
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 3%
Dry Channel: 0 ft

Stream Reach: 2
Channel Type: B2
Bankfull Width: ft
Channel Length: 13014 ft
Riffle/Flatwater Mean Width: 14 ft
Total Pool Mean Depth: 1.1 ft
Base Flow: 0 cfs
Water Temperature: 61-76°F
Air Temperature: 64-84°F
Dominant Bank Vegetation: Grass
Vegetative Cover: 55%
Dominant Bank Substrate: Bedrock
Embeddedness Value: 1: 9% 2: 22% 3: 38% 4: 31% 5: 0%

Canopy Density: 14%
Coniferous Component: 32%
Deciduous Component: 68%
Pools by Stream Length: 12%
Pools >= 3 ft Depth: 4%
Mean Pool Shelter Rating: 26
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 7%
Dry Channel: 0 ft

Stream Reach: 3
Channel Type: A2
Bankfull Width: ft
Channel Length: 1829 ft
Riffle/Flatwater Mean Width: 5 ft
Total Pool Mean Depth: 0.8 ft
Base Flow: 0 cfs
Water Temperature: 61-65°F
Air Temperature: 78-86°F
Dominant Bank Vegetation: Grass
Vegetative Cover: 70%
Dominant Bank Substrate: Bedrock
Embeddedness Value: 1: 0% 2: 40% 3: 30% 4: 30% 5: 0%

Canopy Density: 30%
Coniferous Component: 34%
Deciduous Component: 66%
Pools by Stream Length: 10%
Pools >= 3 ft Depth: 0%
Mean Pool Shelter Rating: 38
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 10%
Dry Channel: 0 ft

One electrofishing site was sampled on Oil Creek, on August 27, 1991. The site sampled was habitat unit 072, a step pool, approximately 5,110 feet from the confluence of the Upper

North Fork Mattole River. The unit had an area of 448 sq ft and a volume of 403.2 cubic feet. The combined total of fish for three passes was 217 steelhead, ranging from 37 to 169 mm fork length, and 4 Pacific lamprey ammocetes, ranging from 70 to 91 mm.

Green Ridge Creek

Green Ridge Creek is a tributary to Oil Creek, a tributary to the Upper North Fork Mattole River, a tributary to the Mattole River located in Humboldt County, California (Figure 1). The legal description at the confluence with Oil Creek is T02S R01W S12. Its location is 40N18'46" N latitude and 124N08'02" W longitude. Green Ridge Creek is a second order stream. The total length of blue line stream, according to the USGS Bull Creek and Buckeye Mountain quadrangles is 1.6 miles. Green Ridge Creek drains a watershed of approximately 1.15 square miles. Douglas fir forest and oak grassland dominate the watershed. The watershed is owned by the Pacific Lumber Company and is managed for timber production and cattle grazing. In the summer of 1991, a timber harvest plan was carried out in this watershed. This was in response to a large portion of the headwaters being subjected to extensive forest fires in the summer of 1990. The road system in this watershed was upgraded under the Department of Fish and Game and the Department of Forestry. This was due to anticipated and projected sediment yield increases from burned areas of the watershed. Vehicle access exists from U.S. Highway 101, via the Bull Creek/Mattole Road.

The habitat inventory of August 9, 1991, was conducted by Shea Monroe and Brian Humphrey (CCC). The total length of the stream surveyed was 3,710 feet. Green Ridge Creek is an A2 channel type from the confluence with Oil Creek to the end of the stream reach surveyed. A2 channels are steep boulder channels, with a 4.0 - 10.0% gradient, and are very well confined.

Survey Data:

Location of Stream Mouth:
Survey Dates: 9/9/91 through 9/9/91
USGS Quad Map: Bull Creek / Buckeye   Latitude: 40º 18' 46"   Longitude: 124º 8' 2"

Stream Reach: 1	
Channel Type: A2	Canopy Density: 21%
Bankfull Width: ft	Coniferous Component: 26%
Channel Length:3710 ft	Deciduous Component: 74%
Riffle/Flatwater Mean Width: 0 ft	Pools by Stream Length: 10%
Total Pool Mean Depth: 0 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 28
Water Temperature: 62-62°F	Dominant Shelter: Boulders
Air Temperature: 78-78°F	Occurrence of Large Organic Debris: 0%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 0%	
Dominant Bank Substrate:	
Embeddedness Value: 1: 9% 2: 27% 3: 27% 4: 36% 5: 0%	

Biological sampling was not conducted in Green Ridge Creek, however YOY steelhead were observed from the streambanks throughout the survey.

Devils Creek

Devils Creek is tributary to Oil Creek, tributary to the Mattole River, located in Humboldt County, California (Figure 1). The legal description at the confluence with Oil Creek is T02S R01W S02. Its location is 40N19'29' N. latitude, 124N08'25". Devils Creek is a second order stream. The total length of blue line stream, according to the USGS Bull Creek and Buckeye Mountain quadrangles is 1.9 miles. Devils Creek drains a watershed of approximately 2.52 square miles. Redwood forest and grassland dominates the watershed. The watershed is privately owned and is managed for timber and livestock grazing. Portions of the Devils Creek watershed were subjected to extensive forest fires during the summer of 1990. Vehicle access exists from U.S. Highway 101, via the Bull Creek/Mattole Road.

The habitat inventory of August 7 and 8, 1991, was conducted by Shea Monroe and Brian Humphrey (CCC). The total length of the stream surveyed was 7,334 feet, with zero feet of side channel. Devils Creek is a B2 channel type for the first 3,475 feet of stream reach surveyed. The remaining 3,859 feet is an A3 channel type. B2 channels are moderate gradient (1.0-2.5%), moderately confined streams, with stable stream banks and boulder dominated substrate. A3 channels are steep gradient (4-10%), very well confined streams with erodible banks and cobble dominated substrate.

Survey Data:

Location of Stream Mouth:
Survey Dates: 8/7/91 through 8/8/91
USGS Quad Map: Buckeye Mountain Latitude: 40º 19' 29" Longitude: 124º 8' 25"

Stream Reach: 1

Channel Type: B2	Canopy Density: 7%
Bankfull Width: ft	Coniferous Component: 66%
Channel Length:3885 ft	Deciduous Component: 34%
Riffle/Flatwater Mean Width: 12 ft	Pools by Stream Length: 14%
Total Pool Mean Depth: 1.0 ft	Pools >= 3 ft Depth: 6%
Base Flow: 0.0 cfs	Mean Pool Shelter Rating: 33
Water Temperature: 64-69ºF	Dominant Shelter: Boulders
Air Temperature: 71-81ºF	Occurrence of Large Organic Debris: 13%
Dominant Bank Vegetation: Grass	Dry Channel: 0 ft
Vegetative Cover: 46%	
Dominant Bank Substrate: Bedrock	

Embeddedness Value: 1: 13% 2: 33% 3: 47% 4: 7% 5: 0%

Stream Reach: 2

Channel Type: A3	Canopy Density: 10%
Bankfull Width: ft	Coniferous Component: 25%
Channel Length:2712 ft	Deciduous Component: 75%
Riffle/Flatwater Mean Width: 13 ft	Pools by Stream Length: 16%
Total Pool Mean Depth: 1.0 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 37
Water Temperature: 71-74ºF	Dominant Shelter: Boulders
Air Temperature: 76-82ºF	Occurrence of Large Organic Debris: 8%
Dominant Bank Vegetation: Grass	Dry Channel: 0 ft
Vegetative Cover: 61%	
Dominant Bank Substrate: Bedrock	

Embeddedness Value: 1: 0% 2: 0% 3: 0% 4: 0% 5: 0%

No biological sampling was conducted on Devils Creek.

Rattlesnake Creek

Rattlesnake Creek is tributary to the Upper North Fork Mattole River, tributary to the Mattole River, located in Humboldt County, California (Figure 1). Rattlesnake Creek's legal description at the confluence with the Upper North Fork Mattole River is T2S R1E S19. Its location is 40N17'27" N. latitude and 124N06'36" W. longitude. Rattlesnake Creek is a third order stream. The total length of blue line stream, according to the USGS Bull Creek quadrangle is 11.0 miles. Rattlesnake Creek drains a watershed of approximately 8.6 square miles. Douglas fir forest and oak grassland dominate the watershed. The watershed is privately owned and is managed for timber production and livestock grazing. Vehicle access exists from U.S. Highway 101, via the Bull Creek/Mattole Road.

The habitat inventory of August 5-9, and 14, 1991, was conducted by Steve Liebhardt and John Crittenden (CCC). The total length of the stream surveyed was 22,452 feet, with an additional 982 feet of side channel. Rattlesnake Creek is a B2 channel type for the first 2,126 feet, a B1 channel type for the next 7,524 feet, and an A3 channel type for the remaining 12,802 of stream reach surveyed. B2 channels are moderate gradient (1.0-2.5%), moderately confined streams, with boulder dominated substrates. B1 channels are moderate gradient (2.5-4.0%), moderately confined, bedrock dominated channel. A2 channels are steep (4-10% gradient), very well confined, boulder channels.

Survey Data:

Location of Stream Mouth:
Survey Dates: 8/5/91 through 8/14/91
USGS Quad Map: Bull Creek Latitude: 40º 17' 27" Longitude: 124º 6' 36"

Stream Reach: 1	
Channel Type: B2	Canopy Density: 8%
Bankfull Width: ft	Coniferous Component: 13%
Channel Length: 2421 ft	Deciduous Component: 87%
Riffle/Flatwater Mean Width: 17 ft	Pools by Stream Length: 11%
Total Pool Mean Depth: 1.1 ft	Pools >= 3 ft Depth: 13%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 37
Water Temperature: 67-76ºF	Dominant Shelter: Boulders
Air Temperature: 77-86ºF	Occurrence of Large Organic Debris: 3%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 55%	
Dominant Bank Substrate: Bedrock	
Embeddedness Value: 1: 0% 2: 17% 3: 83% 4: 0% 5: 0%	

Stream Reach: 2	
Channel Type: B1	Canopy Density: 10%
Bankfull Width: ft	Coniferous Component: 15%
Channel Length: 7167 ft	Deciduous Component: 85%
Riffle/Flatwater Mean Width: 16 ft	Pools by Stream Length: 29%
Total Pool Mean Depth: 1.6 ft	Pools >= 3 ft Depth: 45%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 14
Water Temperature: 64-69ºF	Dominant Shelter: Boulders
Air Temperature: 67-85ºF	Occurrence of Large Organic Debris: 1%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft

Vegetative Cover: 66%
Dominant Bank Substrate: Bedrock
Embeddedness Value: 1: 0% 2: 27% 3: 52% 4: 22% 5: 0%

Stream Reach: 3

Channel Type: A3	Canopy Density: 25%
Bankfull Width: ft	Coniferous Component: 15%
Channel Length: 12515 ft	Deciduous Component: 85%
Riffle/Flatwater Mean Width: 10 ft	Pools by Stream Length: 9%
Total Pool Mean Depth: 1.3 ft	Pools >= 3 ft Depth: 14%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 23
Water Temperature: 60-77°F	Dominant Shelter: Boulders
Air Temperature: 65-86°F	Occurrence of Large Organic Debris: 3%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft

Vegetative Cover: 72%
Dominant Bank Substrate: Bedrock
Embeddedness Value: 1: 0% 2: 30% 3: 47% 4: 23% 5: 0%

One electrofishing site was sampled on Rattlesnake Creek September 5, 1991. The unit sampled was a plunge pool, habitat unit 013, approximately 500 feet from the confluence of the Upper North Fork Mattole River. The combined total of fish was 272 steelhead, ranging from 40 to 175 mm fork length, and 4 sculpin, ranging from 92 to 160 mm.

Eastern Subbasin

Dry Creek

Dry Creek is tributary to the Mattole River, located in Humboldt County, California. Dry Creek's legal description at the confluence with Mattole River is T03S R01E S00. Its location is 40°13′48″ north latitude and 124°03′46″ west longitude. Dry Creek is a third order stream and has approximately 8.8 miles of blue line stream according to the USGS Honeydew 7.5 minute quadrangle. Dry Creek drains a watershed of approximately 5.5 square miles. Elevations range from about 410 feet at the mouth of the creek to 2,280 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for timber production and rural residence. Vehicle access exists via Hwy 101 to Honeydew Road. Travel west approximately eight miles to Panther Gap Road. Directions to the mouth of Dry Creek are available through the landowner.

The habitat inventory of September 22, 1998, was conducted by John Wooster and Caroline Jezierski (AmeriCorps/WSP). The total length of the stream surveyed was 8,548 feet with an additional 227 feet of side channel.

Dry Creek is an F4 channel type for the entire 8,548 feet of stream reach surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel-constrictors, and log cover; and poor for boulder clusters.

Survey Data:

Location of Stream Mouth:
Survey Dates: 9/22/98 through 9/22/98

USGS Quad Map: Honeydew	Latitude: 40º 13' 48" Longitude: 124º 3' 46"
Stream Reach: 1	
Channel Type: F4	Canopy Density: 36%
Bankfull Width: 28 ft	Coniferous Component: 21%
Channel Length:8548 ft	Deciduous Component: 79%
Riffle/Flatwater Mean Width: 9 ft	Pools by Stream Length: 10%
Total Pool Mean Depth: 1.2 ft	Pools >= 3 ft Depth: 16%
Base Flow: 1 cfs	Mean Pool Shelter Rating: 14
Water Temperature: 59-68°F	Dominant Shelter: Boulders
Air Temperature: 64-81°F	Occurrence of Large Organic Debris: 4%
Dominant Bank Vegetation: Grass	Dry Channel: 480
Vegetative Cover: 21%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 3% 3: 32% 4: 63% 5: 3%	

No sites were electrofished during the 1998 steam inventory in Dry Creek. Young-of-the-year (YOY) salmonids were observed from the streambanks by the surveyors throughout the survey reach.

Middle Creek

Middle Creek is tributary to the Mattole River, tributary to the Pacific Ocean, located in Humboldt County, California. Middle Creek's legal description at the confluence with Mattole River is T3S R1E S0. Its location is 40°13′44″ north latitude and 124°02′46″ west longitude. Middle Creek is a first order stream and has approximately 3.6 miles of blue line stream according to the USGS honeydew 7.5 minute quadrangle. Middle Creek drains a watershed of approximately 2.7 square miles. Elevations range from about 430 feet at the mouth of the creek to 2100 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for rangeland. Vehicle access exists via Panther Gap Road to a private road.

The habitat inventory of September 16, 1998, was conducted by Stu McMorrow and John Wooster (AmeriCorps/WSP). The total length of the stream surveyed was 7,475 feet with an additional 422 feet of side channel.

Middle Creek is a B4 channel type for the entire 7,475 feet of stream reach surveyed. B4 channels are moderate in entrenchment and gradient, dominated by riffles with infrequently spaced pools, stable in plan and profile, with stable banks and gravel channels. The suitability of B4 channel types for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs; boulder clusters; bank placed boulders; single and opposing wing deflectors; log cover.

Survey Data:

Location of Stream Mouth:
Survey Dates: 9/16/98 through 9/16/98
USGS Quad Map: Honeydew Latitude: 40º 13' 44" Longitude: 124º 2' 46"

Stream Reach: 1	
Channel Type: B4	Canopy Density: 52%
Bankfull Width: 21.5 ft	Coniferous Component: 1%
Channel Length:7475 ft	Deciduous Component: 99%
Riffle/Flatwater Mean Width: 7 ft	Pools by Stream Length: 10%
Total Pool Mean Depth: 1.2 ft	Pools >= 3 ft Depth: 3%
Base Flow: 0.2 cfs	Mean Pool Shelter Rating: 12
Water Temperature: 57-64ºF	Dominant Shelter: Boulders
Air Temperature: 59-75ºF	Occurrence of Large Organic Debris: 2%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 614
Vegetative Cover: 54%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 0% 3: 54% 4: 37% 5: 9%	

Two sites were electrofished on September 21, 1998, in Middle Creek. The sites were sampled by Barry Collins (CDFG), Ruth Goodfield (CDFG), Caroline Jezierski, and John Wooster (WSP). The first site sampled included habitat units 5-8, approximately 731 feet from the confluence with Mattole. This site had an area of 4,785 sq ft and a volume of 36,366 cu ft. The site yielded 46 steelhead rainbow trout (SHRT) young-of-the-year (YOY), six 1+ SHRT with fork lengths ranging from 100 to 121 mm, and three 2+ SHRT with fork lengths of 152 and 160 mm. The second site included habitat unit 12, located approximately 1,393 feet above the creek mouth. This site had an area of 576 sq ft and a volume of 288 cu ft. The site yielded seventy-six SHRT YOY and four 1+ SHRT with fork lengths ranging from 82 to 106 mm.

Westlund Creek

Westlund Creek is a tributary to the Mattole River, located in Humboldt County, California. Westlund Creek's legal description at the confluence with Mattole River is T3S R1E S00. Its location is 40°13′41″ north latitude and 124°02′26″ west longitude. Westlund Creek is a second order stream and has approximately 4.4 miles of blue line stream according to the USGS Honeydew 7.5 minute quadrangle. Westlund Creek drains a watershed of approximately 4.7 square miles. Elevations range from about 400 feet at the mouth of the creek to 2,000 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for timber production and rural residence. Vehicle access exists from Hwy 101 via the Bull Creek - Honeydew Road exit. Travel west approximately eight miles to Panther Gap Road. Further directions to the mouth of Westlund Creek are available from the local landowners.

The habitat inventory of September 8 to 14, 1998, was conducted by John Wooster and Caroline Jezierski (AmeriCorps/WSP). The total length of the stream surveyed was 16,979 feet with an additional 348 feet of side channel.

Westlund Creek is a B4 channel type for the first 12,331 feet of stream reach surveyed, and an A4 type for the remaining 4,648 feet of surveyed stream. B4 channels are moderately entrenched, meandering, riffle/pool channels on 2-4% gradients with moderate width/depth ratios and gravel-dominant substrates. A4 channels are steep, narrow, cascading, step-pool streams with high energy/debris transport associated with depositional soils and gravel-dominant substrates. The suitability of B4 channel types for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs, boulder clusters, bank-placed boulders, single and opposing wing-deflectors, and log cover. The suitability of A4 channel types is as follows: good for bank-placed boulders; fair for plunge weirs, opposing wing-deflectors, and log cover; and poor for boulder clusters and single wing-deflectors.

Survey Data:

Location of Stream Mouth:
Survey Dates: 9/8/98 through 9/15/98
USGS Quad Map: Honeydew Latitude: 40º 13' 41" Longitude: 124º 2' 26"

Stream Reach: 1

Channel Type: B4	Canopy Density: 85%
Bankfull Width: 21 ft	Coniferous Component: 3%
Channel Length:12331 ft	Deciduous Component: 98%
Riffle/Flatwater Mean Width: 10 ft	Pools by Stream Length: 13%
Total Pool Mean Depth: 1.3 ft	Pools >= 3 ft Depth: 7%
Base Flow: 0.8 cfs	Mean Pool Shelter Rating: 16
Water Temperature: 65-66ºF	Dominant Shelter: Boulders
Air Temperature: 62-81ºF	Occurrence of Large Organic Debris: 1%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 64%	
Dominant Bank Substrate: Cobble/Gravel	

Embeddedness Value: 1: 0% 2: 32% 3: 56% 4: 4% 5: 9%

Stream Reach: 2

Channel Type: A4	Canopy Density: 78%
Bankfull Width: 21 ft	Coniferous Component: 15%
Channel Length:4648 ft	Deciduous Component: 85%
Riffle/Flatwater Mean Width: 5 ft	Pools by Stream Length: 3%
Total Pool Mean Depth: 1.3 ft	Pools >= 3 ft Depth: 25%
Base Flow: 0.8 cfs	Mean Pool Shelter Rating: 23
Water Temperature: 61-63ºF	Dominant Shelter: Boulders
Air Temperature: 71-74ºF	Occurrence of Large Organic Debris: 2%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 54%	
Dominant Bank Substrate: Cobble/Gravel	

Embeddedness Value: 1: 0% 2: 67% 3: 25% 4: 8% 5: 0%

Four sites were electrofished on September 24, 1998, in Westlund Creek. The sites were sampled by Barry Collins, Ruth Goodfield (CDFG), John Wooster, and Caroline Jezierski (AmeriCorps/WSP). The first site sampled included habitat units 0118-0119, a step run/pool sequence located approximately 6,013 feet above the confluence with Mattole River. The site had an area of 400 sq ft and a volume of 360 cu ft. The site yielded 98 young-of -the-year (YOY) steelhead, five age 1+ steelhead rainbow trout (SHRT) ranging in length from 81-133mm fork length (FL), and two 2+ SHRT with fork lengths of 148mm and 150mm. The second site sampled included habitat units 0121-0122, a riffle/pool sequence located approximately 6,296 feet above the creek mouth. The site had an area of 460 sq ft and a volume of 368 cu ft. The site yielded 34 YOY steelhead, two age 1+ SHRT with 101 and 104mm FL, and two 2+ SHRT with 155 and 166mm FL.

The third site sampled included habitat unit 0125-0126, a riffle/pool sequence approximately 6,514 feet from the confluence with Mattole River. This site had an area of 360 sq ft and a volume of 324 cu ft. The site yielded nine YOY steelhead, ranging in size from 47 to 74mm FL and two age 1+ SHRT measuring 94mm and 123mm FL.

The fourth site included habitat units 0127-0128, a riffle/pool sequence located approximately 6,554 feet above the creek mouth. This site had an area of 400 sq ft and a volume of 360 cu ft. The site yielded eight YOY steelhead/rainbow trout ranging in size from 40 to 70mm FL and two age 1+ SHRT measuring 103mm and 122mm FL.

Gilham Creek

Gilham Creek is tributary to the Mattole River, tributary to the Pacific Ocean, located in Humboldt County, California. Gilham Creek's legal description at the confluence with Mattole River is T03S R01E S00. Its location is 40°12′46″ north latitude and 124°02′46″ west longitude. Gilham Creek is a second order stream and has approximately 2.5 miles of blue line stream according to the USGS Honeydew 7.5 minute quadrangle. Gilham Creek drains a watershed of approximately 3.09 square miles. Elevations range from about 480 feet at the mouth of the creek to 2400 feet in the headwater areas. Douglas fir, oak, and mixed hardwood forest dominates the watershed. The watershed is primarily privately owned, with about 10% of the upper watershed owned by the Bureau of Land Management. The watershed is managed for timber production and rangeland. Vehicle access exists via Mattole Road to Honeydew. From Honeydew take the Wilder Ridge Road. Follow the Wilder Ridge Road for 3.5 miles, then take the Jeep trail to Pringle Ridge. After Pringle Ridge the Jeep trail will fork, take the right fork. Follow the Jeep trail to the Mattole River. Once you arrive at the river, hike upstream and stay to the right. On the river's left will be the confluence of Gilham Creek with the Mattole River.

The habitat inventory of August 24, 25, and 26, 1998, was conducted by Stu McMorow and John Wooster, AmeriCorps/WSP. The total length of the stream surveyed was 13,780 feet with an additional 112 feet of side channel.

Gilham Creek is a B4 channel type for the first 9,992 feet and an A3 channel type for the remaining 3,788 feet of the stream reach surveyed. B4 channel types are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools; very stable plan and profile; stable banks; gravel channel. A3 channel types are steep, narrow, cascading, step-pool streams; high energy/debris transport associated with depositional soils; cobble channel. The suitability of B4 channel types for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs; boulder clusters; bank placed boulders; single and opposing wing-deflectors; log cover. The suitability of A3 channel types is: good for bank-placed boulders; fair for plunge weirs, opposing wing-deflectors and log cover; poor for boulder clusters and single wing-deflectors.

Survey Data:

Location of Stream Mouth:
Survey Dates: 8/24/98 through 8/26/98
USGS Quad Map: Honeydew Latitude: 40º 12' 46" Longitude: 124º 2' 23"

Stream Reach: 1

Channel Type: B4	Canopy Density: 73%
Bankfull Width: ft	Coniferous Component: 11%
Channel Length:9992 ft	Deciduous Component: 89%
Riffle/Flatwater Mean Width: 11 ft	Pools by Stream Length: 13%
Total Pool Mean Depth: 1.4 ft	Pools >= 3 ft Depth: 5%
Base Flow: 0.9 cfs	Mean Pool Shelter Rating: 33
Water Temperature: 59-65°F	Dominant Shelter: Boulders
Air Temperature: 63-86°F	Occurrence of Large Organic Debris: 5%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 67%	
Dominant Bank Substrate: Cobble/Gravel	

Embeddedness Value: 1: 2% 2: 31% 3: 45% 4: 2% 5: 21%

Stream Reach: 2

Channel Type: A2	Canopy Density: 71%
Bankfull Width: ft	Coniferous Component: 85%
Channel Length:3788 ft	Deciduous Component: 15%
Riffle/Flatwater Mean Width: 10 ft	Pools by Stream Length: 6%
Total Pool Mean Depth: 1.3 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0.9 cfs	Mean Pool Shelter Rating: 14
Water Temperature: 60-62°F	Dominant Shelter: Boulders
Air Temperature: 67-68°F	Occurrence of Large Organic Debris: 0%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 83%	
Dominant Bank Substrate: Cobble/Gravel	

Embeddedness Value: 1: 0% 2: 13% 3: 75% 4: 0% 5: 13%

A biological inventory was preformed on Gilham Creek on September 3, 1998 by Scott Downie, Ruth Goodfield, Stu McMorrow, and John Wooster. The sample site was located approximately 100' above the confluence with the Mattole River. Twenty-three steelhead were sampled; three within the normal range of 2+ juveniles; three within the normal range of 1+ juveniles; and 17 within the normal range of 0+ fingerlings. No other fish were sampled.

Gilham Creek Tributary #1

Unnamed Tributary to Gilham Creek is tributary to Gilham Creek, tributary to the Mattole River, located in Humboldt County, California (Map 1). Unnamed Tributary to Gilham Creek's legal description at the confluence with Gilham Creek River is T03S R01E S13. Its location is 40°12′56.2″ North latitude and 124°01′27.7″ West longitude. Unnamed Tributary to Gilham Creek is a first order stream and has approximately 2.04 miles of intermittent stream according to the USGS Honeydew 7.5 minute quadrangle. Unnamed Tributary to Gilham Creek drains a watershed of approximately 1.04 square miles. Elevations range from about 720 feet at the mouth of the creek to 2760 feet in the headwater areas. Douglas fir, oak and mixed hardwood forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production and rangeland. See Gilham Creek for vehicle access.

The habitat inventory of August 25, 1998, was conducted by Stu McMorrow and John Wooster (AmeriCorps/WSP). The total length of the stream surveyed was 3,051 feet with no side channel.

Unnamed Tributary to Gilham Creek is a B4 channel type for the entire 3,051 feet of stream reach surveyed. B4 channel types are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools; very stable floodplain and profile; stable banks; and gravel dominated channel. The suitability of B4 channel types for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs; boulder clusters; bank placed boulders; single and opposing wing-deflectors; log cover.

Survey Data:

Location of Stream Mouth:
Survey Dates: 8/25/98 through 8/25/98
USGS Quad Map: Honeydew Latitude: 40º 12' 56" Longitude: 124º 1' 28"

Stream Reach: 1	
Channel Type: B4	Canopy Density: 74%
Bankfull Width: ft	Coniferous Component: 22%
Channel Length:3051 ft	Deciduous Component: 78%
Riffle/Flatwater Mean Width: 11 ft	Pools by Stream Length: 5%
Total Pool Mean Depth: 1.2 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 27
Water Temperature: 62-63°F	Dominant Shelter: Boulders
Air Temperature: 69-73°F	Occurrence of Large Organic Debris: 3%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 49 ft
Vegetative Cover: 80%	
Dominant Bank Substrate: Cobble/Gravel	

Embeddedness Value: 1: 0% 2: 40% 3: 40% 4: 0% 5: 20%

Young-of-the-year and juvenile salmonids were seen using streambank observation during the course of the survey on Unnamed Tributary to Gilham Creek. No biological sampling was conducted.

Fourmile Creek

Fourmile Creek is tributary to the Mattole River, tributary to the Pacific Ocean, located in Humboldt County, California. Fourmile Creek's legal description at the confluence with Mattole River is T3S R1E S0. Its location is 40°11′52″ north latitude and 124°03′22″ west longitude. Fourmile Creek is a third order stream and has approximately 7.3 miles of blue line stream according to the USGS Honeydew 7.5 minute quadrangle. Fourmile Creek drains a watershed of approximately 5. 5 square miles. Elevations range from about 480 feet at the mouth of the creek to 1400 feet in the headwater areas. Douglas fir forest and mixed hardwood forest dominate the watershed. The watershed is privately owned and is managed for timber production and rangeland. Vehicle access exists via Mattole Road to Honeydew. From Honeydew take the Wilder Ridge Road approximately 3.5 miles, then turn left onto Pringle Ridge Road. Continue along Pringle Ridge Road for approximately 3.5 miles and then turns into a jeep trail that continues down to the Mattole River.

The habitat inventory of August 25-26 and September 2, 1998, was conducted by C. Jezierski, P. Retherford, and J. Wooster (AmeriCorps/WSP). The total length of the stream surveyed was 15,566 feet with an additional 62 feet of side channel.

Fourmile Creek is a C4 channel type for the first 6,948 feet, and a F4 channel type for last 8,618 feet of the stream reach surveyed. C4 channel types are low gradient, meandering, point-bar, riffle/pool, alluvial channels with broad, well defined floodplain; gravel channel. F4 channel types are entrenched meandering riffle/pool channel on low gradients with high width/depth ratio; gravel channel. The suitability of C4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders and fair for plunge weirs; single and opposing wing-deflectors; channel constrictors; log cover. The suitability of F4 channel types is: good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, log cover; and poor for boulder clusters.

Survey Data:

Location of Stream Mouth:
Survey Dates: 8/25/98 through 8/26/98
USGS Quad Map: Honeydew   Latitude: 40º 11' 52"   Longitude: 124º 3' 22"

Stream Reach: 1

Channel Type: C4	Canopy Density: 43%
Bankfull Width: 52 ft	Coniferous Component: 20%
Channel Length:6948 ft	Deciduous Component: 80%
Riffle/Flatwater Mean Width: 8 ft	Pools by Stream Length: 18%
Total Pool Mean Depth: 1.4 ft	Pools >= 3 ft Depth: 33%
Base Flow: 0.6 cfs	Mean Pool Shelter Rating: 16
Water Temperature: 59-73ºF	Dominant Shelter: Boulders
Air Temperature: 58-86ºF	Occurrence of Large Organic Debris: 8%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 71%	
Dominant Bank Substrate: Cobble/Gravel	

Embeddedness Value: 1: 3%   2: 20%   3: 43%   4: 30%   5: 3%

Stream Reach: 2

Channel Type: F4	Canopy Density: 61%
Bankfull Width: 38 ft	Coniferous Component: 11%
Channel Length:8618 ft	Deciduous Component: 89%
Riffle/Flatwater Mean Width: 8 ft	Pools by Stream Length: 12%
Total Pool Mean Depth: 1.5 ft	Pools >= 3 ft Depth: 10%
Base Flow: 0.6 cfs	Mean Pool Shelter Rating: 28
Water Temperature: 59-68ºF	Dominant Shelter: Boulders
Air Temperature: 65-94ºF	Occurrence of Large Organic Debris: 5%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 1199
Vegetative Cover: 78%	
Dominant Bank Substrate: Cobble/Gravel	

Embeddedness Value: 1: 0%   2: 26%   3: 60%   4: 5%   5: 10%

Three sites were electrofished on September 3, 1998 in Fourmile Creek. The sites were sampled by Janet Lester and Paul Retherford (AmeriCorps/WSP). The first site sampled included habitat units 07- 09, approximately 500 feet from the confluence with the Mattole

River. This site had an area of approximately 520 sq ft and a volume of 256 cu ft. The site yielded twenty-three young of the year steelhead trout, and one steelhead trout age 2+.

The second site included habitat units 45- 46, located approximately 3,185 feet above the creek mouth. This site had an area of approximately 790 sq ft and a volume of 966 cu ft. The site yielded seven young of the year steelhead.

The third site sampled included habitat units 100-101, located approximately 6,400 feet above the creek mouth. The site had an area of 482 sq ft and a volume of 357 cu ft. The site yielded fourteen young of the year steelhead, seven steelhead age 1+, one amphibian, and one salamander.

North Fork Fourmile Creek

The North Fork of Fourmile Creek is a tributary to Fourmile Creek, tributary to the Mattole River, tributary to the Pacific Ocean. The North Fork of Fourmile Creek's legal description at the confluence with Fourmile Creek is T03S R01E S21. Its location is 40°11'58" north latitude and 124°04'00" west longitude. The North Fork of Fourmile Creek is a second order stream according to the USGS Honeydew 7.5 minute quadrangles. The North Fork of Fourmile Creek drains a watershed of approximately 1.7 square miles. Elevations range from about 600 feet at the mouth of the creek to 1600 feet in the headwater areas. Douglas fir forest and mixed hardwood forest dominates the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via the Mattole Road to Honeydew. Travel on Wilder Ridge Road from Honeydew approximately 3.5 miles and turn left onto Pringle Ridge Road. Travel on Pringle Ridge Road for approximately 3.5 miles and follow jeep trail down to the Mattole River.

The habitat inventory of August 27, 1998 was conducted by C. Jezierski and P. Retherford (AmeriCorps/WSP). The total length of the stream surveyed was 6,187 feet.

The North Fork of Fourmile Creek is a C4 channel type for the entire 6,187 feet. C4 channel types are low gradient, meandering, point-bar, riffle/pool, alluvial channels with broad, well-defined flood plain and a gravel dominated channel. The suitability of C4 channels for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover.

Survey Data:
Location of Stream Mouth:
Survey Dates: 8/27/98 through 8/27/98
USGS Quad Map: Honeydew Latitude: 40º 11' 58" Longitude: 124º 4' 0"

Stream Reach: 1
Channel Type: C4
Bankfull Width: ft
Channel Length:2697 ft
Riffle/Flatwater Mean Width: 5 ft
Total Pool Mean Depth: 0.9 ft
Base Flow: 0 cfs
Water Temperature: 61-61ºF
Air Temperature: 68-71ºF
Dominant Bank Vegetation: Deciduous Trees
Vegetative Cover: 61%
Dominant Bank Substrate: Cobble/Gravel

Canopy Density: 46%
Coniferous Component: 26%
Deciduous Component: 74%
Pools by Stream Length: 6%
Pools >= 3 ft Depth: 0%
Mean Pool Shelter Rating: 15
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 21%
Dry Channel: 0 ft

Embeddedness Value: 1: 0% 2: 0% 3: 38% 4: 63% 5: 0%

Stream Reach: 2	
Channel Type: A4	Canopy Density: 51%
Bankfull Width: ft	Coniferous Component: 34%
Channel Length:3490 ft	Deciduous Component: 66%
Riffle/Flatwater Mean Width: 5 ft	Pools by Stream Length: 11%
Total Pool Mean Depth: 0.9 ft	Pools >= 3 ft Depth: 4%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 23
Water Temperature: 63-80°F	Dominant Shelter: Boulders
Air Temperature: 76-83°F	Occurrence of Large Organic Debris: 7%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 404
Vegetative Cover: 48%	
Dominant Bank Substrate: Cobble/Gravel	

Embeddedness Value: 1: 0% 2: 22% 3: 30% 4: 48% 5: 0%

No biological sampling was conducted on the North Fork of Fourmile Creek.

Sholes Creek

Sholes Creek is tributary to the Mattole River, located in Humboldt County, California. Sholes Creek's legal description at the confluence with Mattole River is T03S R01E S--. Its location is 40°11′18″ north latitude and 124°02′04″ west longitude. Sholes Creek is a second order stream and has approximately 6.0 miles of blue line stream according to the USGS Honeydew 7.5 minute quadrangle. Sholes Creek drains a watershed of approximately 4.2 square miles. Elevations range from about 520 feet at the mouth of the creek to 1,700 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for rural residence and timber harvest. Vehicle access exists via Briceland/Shelter Cove Road west to the Ettersburg turnoff. At Ettersburg, take the Wilder Ridge Road west approximately 1.8 miles to a private dirt road, which leads to the mouth of Sholes Creek.

The habitat inventory of September 17, and 24, 1998, was conducted by John Wooster and Stewart McMorrow (AmeriCorps/WSP). The total length of the stream surveyed was 21,247 feet with an additional 119 feet of side channel.

Sholes Creek is a B4 channel type for the entire 21,247 feet of stream reach surveyed. B4 channels are moderately entrenched, meandering, riffle/pool channels on 2-4% gradients with moderate width/depth ratios and gravel-dominant substrates. The suitability of B4 channel types for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs, boulder clusters, bank-placed boulders, single and opposing wing-deflectors and log cover.

Survey Data:

Location of Stream Mouth:
Survey Dates: 9/17/98 through 9/24/98
USGS Quad Map: Honeydew Latitude: 40º 11' 18" Longitude: 124º 2' 4"

Stream Reach: 1	
Channel Type: B4	Canopy Density: 78%
Bankfull Width: 24 ft	Coniferous Component: 14%
Channel Length:21147 ft	Deciduous Component: 86%

Riffle/Flatwater Mean Width: 8 ft	Pools by Stream Length: 22%
Total Pool Mean Depth: 1.4 ft	Pools >= 3 ft Depth: 20%
Base Flow: 0.3 cfs	Mean Pool Shelter Rating: 39
Water Temperature: 54-61°F	Dominant Shelter: Boulders
Air Temperature: 57-73°F	Occurrence of Large Organic Debris: 9%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 476
Vegetative Cover: 65%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 24% 3: 69% 4: 5% 5: 2%	

No biological sampling was conducted on Sholes Creek.

Harrow Creek

Harrow Creek is tributary to the Mattole River, located in Humboldt County, California. Harrow Creek's legal description at the confluence with Mattole River is T3S R1E S25. Its location is 40°10′35″ north latitude and 124°01′15″ west longitude. Harrow Creek is a first order stream and has approximately 2.8 miles of intermittent stream according to the USGS Honeydew 7.5 minute quadrangle. Harrow Creek drains a watershed of approximately 1.0 square miles. Elevations range from about 520 feet at the mouth of the creek to 1140 feet in the headwater areas. Douglas fir, oak, and mixed hardwood forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production and rangeland. Vehicle access exists from Etterburg via Wilder Ridge Road.

The habitat inventory of September 2, 1998, was conducted by Paul Retherford and Janet Lester (AmeriCorps/WSP). The total length of the stream surveyed was 1,222 feet .

Harrow Creek is a B3 channel type for the entire 1,222 feet of stream reach surveyed. B3 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools; very stable plan and profile; stable banks; cobble channel. The suitability of B3 channel types for fish habitat improvement structures is as follows: excellent for plunge weirs, boulder clusters and bank placed boulder, single and opposing wing-deflectors and log cover.

Survey Data:

Location of Stream Mouth:
Survey Dates: 9/2/98 through 9/2/98
USGS Quad Map: Honeydew   Latitude: 40º 10' 35"   Longitude: 124º 1' 15"

Stream Reach: 1	
Channel Type: B3	Canopy Density: 99%
Bankfull Width: 12.7 ft	Coniferous Component: 3%
Channel Length:1222 ft	Deciduous Component: 97%
Riffle/Flatwater Mean Width: 6 ft	Pools by Stream Length: 30%
Total Pool Mean Depth: 1 ft	Pools >= 3 ft Depth: 7%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 35
Water Temperature: 60-64°F	Dominant Shelter: Boulders
Air Temperature: 68-76°F	Occurrence of Large Organic Debris: 0%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 105
Vegetative Cover: 45%	
Dominant Bank Substrate: Cobble/Gravel	

Embeddedness Value: 1: 13% 2: 7% 3: 27% 4: 27% 5: 27%

One site was electrofished on September 2, 1998 in Harrow Creek. The sites were sampled by Janet Lester and Paul Retherford (CDFG and AmeriCorps/WSP). The site sampled included habitat units 003 - 005, approximately 41 feet from the confluence with the Mattole River. This site had an area of 780 sq ft and a volume of 266.5 cu ft. The site yielded 10 young of the year steelhead.

Little Grindstone Creek

Little Grindstone Creek is tributary to the Mattole River, tributary to the Pacific Ocean, located in Humboldt County, California. Little Grindstone Creek's legal description at the confluence with Mattole River is T03S R01E S25. Its location is 40°10′32″ north latitude and 124°00′28″ west longitude. Little Grindstone Creek is a first order stream and has approximately 0.6 miles of intermittent stream according to the USGS Honeydew 7.5 minute quadrangle. However, during the survey, the creek had 3,000 feet of flowing stream. Little Grindstone Creek drains a watershed of approximately 0.6 square miles. Elevations range from about 550 feet at the mouth of the creek to 1,560 feet in the headwater areas. Douglas fir forest and hardwood forest dominate the watershed. The watershed is privately owned and is managed for timber production and rangeland. Vehicle access exists via Mattole Road to Honeydew. From Honeydew take the Wilder Ridge Road. After passing the turnoff for Horse Mountain Road, continue along the Wilder Ridge Road eastward and then turn left on the second unimproved dirt road. Follow it until it crosses the Mattole River. Little Grindstone Creek will be the second creek on right bank (facing downstream) that enters the Mattole River upstream from the crossing.

The habitat inventory of September 9, 1998, was conducted by John Wooster and Caroline Jerzierski (AmeriCorps/WSP). The total length of the stream surveyed was 2,991 feet.

Little Grindstone Creek is a B4 channel type for the entire 2,991 feet of stream reach surveyed. B4 channel types are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools; very stable plan and profile; stable banks and gravel channels. The suitability of B4 channels for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors and log cover.

<u>*Survey Data:*</u>

Location of Stream Mouth:
Survey Dates: 9/9/98 through 9/9/98
USGS Quad Map: Honeydew Latitude: 40º 10' 32" Longitude: 124º 0' 28"

Stream Reach: 1	
Channel Type: B4	Canopy Density: 88%
Bankfull Width: 14 ft	Coniferous Component: 5%
Channel Length:2991 ft	Deciduous Component: 95%
Riffle/Flatwater Mean Width: 4 ft	Pools by Stream Length: 6%
Total Pool Mean Depth: 0.8 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0.1 cfs	Mean Pool Shelter Rating: 20
Water Temperature: 59-62ºF	Dominant Shelter: Boulders
Air Temperature: 64-74ºF	Occurrence of Large Organic Debris: 2%

Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 164
Vegetative Cover: 52%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 7% 2: 43% 3: 50% 4: 0% 5: 0%	

No biological sampling was conducted on Little Grindstone Creek.

Grindstone Creek

Grindstone Creek is tributary to the Mattole River, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Grindstone Creek's legal description at the confluence with Mattole River is T03S R01E S25. Its location is 40°10′30″ north latitude and 124°00′41″ west longitude. Grindstone Creek is a first order stream and has approximately 3.4 miles of blue line stream according to the USGS Honeydew 7.5 minute quadrangle. Grindstone Creek drains a watershed of approximately 3.8 square miles. Elevations range from about 520 feet at the mouth of the creek to 2400 feet in the headwater areas. Douglas fir forest and mixed hardwood dominate the watershed. The watershed is primarily privately owned and is managed for timber production and rangeland. Vehicle access exists via Mattole Road to Honeydew. From Honeydew take the Wilder Ridge Road. After passing the turnoff for Horse Mountain Road, continue along the Wilder Ridge Road eastward and then turn left on the second unimproved dirt road. Follow it until it crosses the Mattole River. Grindstone Creek will be the first creek on right bank.

The habitat inventory of August 27, 31, and September 1, 1998, was conducted by John Wooster and Stu McMorrow (AmeriCorps/WSP). The total length of the stream surveyed was 13,772 feet with an additional 124 feet of side channel.

Grindstone Creek is a B4 channel type for the entire 14,155 feet of stream reach surveyed. B4 channel types are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools; very stable plan and profile; stable banks; gravel channel. The suitability of B4 channel types for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover.

<u>*Survey Data:*</u>

Location of Stream Mouth:
Survey Dates: 8/27/98 through 9/1/98
USGS Quad Map: Honeydew   Latitude: 40º 10' 30"   Longitude: 124º 0' 41"

Stream Reach: 1	
Channel Type: B4	Canopy Density: 51%
Bankfull Width: ft	Coniferous Component: 21%
Channel Length:13772 ft	Deciduous Component: 79%
Riffle/Flatwater Mean Width: 10 ft	Pools by Stream Length: 12%
Total Pool Mean Depth: 1.4 ft	Pools >= 3 ft Depth: 18%
Base Flow: 0.7 cfs	Mean Pool Shelter Rating: 18
Water Temperature: 64-72ºF	Dominant Shelter: Boulders
Air Temperature: 70-89ºF	Occurrence of Large Organic Debris: 2%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 55%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 21% 3: 63% 4: 11% 5: 5%	

One site was electrofished on September 3, 1998 on Grindstone Creek. The site was sampled by Scott Downie, Heidi Hickethier, and Carolyn Jezierski, (CDFG and AmeriCorps/WSP). The site sampled included 3 habitat units, a mid-channel pool, a riffle, and a run and was located approximately 300 feet from the confluence with the Mattole River. This site had an area of 420 sq ft and a volume of 514 cu ft. The site yielded 30 juvenile steelhead and 1 threespine stickleback. The breakdown of steelhead age classes was: 21 steelhead rainbow trout (SHRT) Young-of-the-year (YOY), 5 SHRT 1+, and 4 SHRT 2+.

Blue Slide Creek

Blue Slide Creek is tributary to the Mattole River, located in Humboldt County, California. Blue Slide Creek's legal description at the confluence with the Mattole River is T04S R02E S06. Its location is 40°08’37" north latitude and 123°59’24" west longitude. Blue Slide Creek is a third order stream and has approximately 7.8 miles of blue line stream according to the USGS Ettersburg 7.5 minute quadrangle. Blue Slide Creek drains a watershed of approximately 9.9 square miles. Elevations range from about 600 feet at the mouth of the creek to 2,200 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for timber rural residence. Vehicle access exists via the Briceland/Shelter Cove Road to Telegraph Ridge Road. Travel on Telegraph Ridge Road to Ettersburg and Blue Slide Creek.

The habitat inventory of July 20, 21, and 22, 1998, was conducted by Stewart McMorrow and Kelley Turner (AmeriCorps/WSP). The total length of the stream surveyed was 33,416 feet. Blue Slide Creek is a F4 channel type for the entire 33,416 feet of stream reach surveyed. F4 channels are entrenched meandering riffle/pool gravel channels on low gradients with high width/depth ratio.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/20/1998 through 7/22/1998
USGS Quad Map: Ettersburg Latitude: 40º 8' 37" Longitude: 123º 59' 24"

Stream Reach: 1

Channel Type: F4	Canopy Density: 46%
Bankfull Width: ft	Coniferous Component: 6%
Channel Length:33416 ft	Deciduous Component: 94%
Riffle/Flatwater Mean Width: 11 ft	Pools by Stream Length: 22%
Total Pool Mean Depth: 2.2 ft	Pools >= 3 ft Depth: 39%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 23
Water Temperature: 60-79ºF	Dominant Shelter: Boulders
Air Temperature: 64-89ºF	Occurrence of Large Organic Debris: 3%
Dominant Bank Cover: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 75%	
Dominant Bank Substrate Cobble/Gravel	

Embeddedness Value: 1: 0% 2: 23% 3: 50% 4: 16% 5: 12%

Fire Creek

Fire Creek is tributary to Blue Slide Creek, tributary to the Mattole River, located in Humboldt County, California. Fire Creek's legal description at the confluence with Blue Slide Creek is T04S R02E S09. Its location is 40°08′09″ North latitude and 123°57′50″

West longitude. Fire Creek is a second order stream and has approximately 2.9 miles of blue line stream according to the USGS Ettersburg 7.5 minute quadrangle. Fire Creek drains a watershed of approximately 1.5 square miles. Elevations range from about 760 feet at the mouth of the creek to 1,500 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for timber rural residence. Vehicle access exists via the Briceland/Shelter Cove Road to the China Creek Road. Drive approximately one mile to a main fork in the road. Take the south fork over the hill to the mouth of Fire Creek.

The habitat inventory of July 21 to August 4, 1998, was conducted by Stewart McMorrow and Kelley Turner (AmeriCorps/WSP). The total length of the stream surveyed was 10,723 feet with an additional 80 feet of side channel.

Fire Creek is an F4 channel type for the entire 10,723 feet of stream reach surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for plunge-weirs, single and opposing wing-deflectors, channel constrictors, and log cover; and poor for boulder clusters.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/21/98 through 8/4/98
USGS Quad Map: Ettersburg Latitude: 40º 8' 9" Longitude: 123º 57' 50"

Stream Reach: 1	
Channel Type: F4	Canopy Density: 67%
Bankfull Width: ft	Coniferous Component: 15%
Channel Length:10723 ft	Deciduous Component: 85%
Riffle/Flatwater Mean Width: 6 ft	Pools by Stream Length: 6%
Total Pool Mean Depth: 1.2 ft	Pools >= 3 ft Depth: 3%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 31
Water Temperature: 63-80°F	Dominant Shelter: Boulders
Air Temperature: 73-89°F	Occurrence of Large Organic Debris: 12%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 68%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 3% 3: 27% 4: 43% 5: 27%	

No sites were electrofished during the 1998 summer stream survey in Fire Creek. Juvenile salmonids were observed from the streambanks by the surveyors throughout the entire length of stream surveyed.

Box Canyon Creek

Box Canyon Creek is tributary to the Mattole River, tributary to the Pacific Ocean, located in Humboldt County, California. Box Canyon Creek's legal description at the confluence with the Mattole River is T04S R02E S18. Its location is 40°07'24" north latitude and 123°59'45" west longitude. Box Canyon Creek is a first order stream and has approximately 0.6 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangles. Box Canyon Creek drains a watershed of approximately 0.8 square miles. Elevations range from about 620 feet at the mouth of the creek to 1,200 feet in the headwater areas. Redwood, Douglas fir, and mixed hardwood forest dominate the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists from U.S. Highway 101 at Redway. Take the Briceland Road through Briceland and continue on to Ettersburg Road. Turn right onto Ettersburg Road and follow to the French Ranch Road. Follow the private ranch road for about 2.5 miles to the mouth of Box Canyon Creek. This private road is only accessible with prior permission from the landowner.

The habitat inventory of July 11 and 12, 2000 was conducted by Dan Kintz and Johanna Schussler (WSP). The total length of the stream surveyed was 2,776 feet with an additional 12 feet of side channel. Box Canyon Creek is a F4 channel type for the first 777 feet of stream reach surveyed, a B4 channel type for the next 1,208 feet, and a B2 channel type for the final 791 feet. F4 channels are entrenched meandering riffle/pool gravel channels on low gradients with high width/depth ratio. B4 channels are moderately entrenched, meandering, riffle/pool channels on gradients of 2-4% with moderate width/depth ratios and gravel-dominant substrates. B2 channels are moderate gradient (1.0-2.5%), moderately confined, with stable streambanks and boulder dominated substrate.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/11/2000 through 7/12/2000
USGS Quad Map: Briceland Latitude: 40º 7' 24" Longitude: 123º 59' 45"

Stream Reach: 1
Channel Type: F4
Bankfull Width: 15 ft
Channel Length:777 ft
Riffle/Flatwater Mean Width: 8 ft
Total Pool Mean Depth: 0.5 ft
Base Flow: 0.2 cfs
Water Temperature: 65-67°F
Air Temperature: 79-83°F
Dominant Bank Cover: Deciduous Trees
Vegetative Cover: 79%
Dominant Bank Substrate Cobble/Gravel
Embeddedness Value: 1: 43% 2: 14% 3: 29% 4: 14% 5: 0%
Canopy Density: 46%
Coniferous Component: 5%
Deciduous Component: 95%
Pools by Stream Length: 15%
Pools >= 3 ft Depth: 13%
Mean Pool Shelter Rating: 13
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 0%
Dry Channel: 0 ft

Stream Reach: 2
Channel Type: B4
Bankfull Width: 13 ft
Channel Length:1208 ft
Riffle/Flatwater Mean Width: 7 ft
Total Pool Mean Depth: 0.6 ft
Base Flow: 0.2 cfs
Water Temperature: 68-69°F
Air Temperature: 79-85°F
Dominant Bank Cover: Deciduous Trees
Vegetative Cover: 86%
Dominant Bank Substrate Cobble/Gravel
Embeddedness Value: 1: 13% 2: 13% 3: 25% 4: 0% 5: 50%
Canopy Density: 62%
Coniferous Component: 6%
Deciduous Component: 94%
Pools by Stream Length: 11%
Pools >= 3 ft Depth: 0%
Mean Pool Shelter Rating: 50
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 6%
Dry Channel: 0 ft

Stream Reach: 3
Channel Type: B2
Canopy Density: 66%

Bankfull Width: 10 ft	Coniferous Component: 7%
Channel Length:791 ft	Deciduous Component: 93%
Riffle/Flatwater Mean Width: 7 ft	Pools by Stream Length: 16%
Total Pool Mean Depth: 1.4 ft	Pools >= 3 ft Depth: 25%
Base Flow: 0.2 cfs	Mean Pool Shelter Rating: 10
Water Temperature: 60-63ºF	Dominant Shelter: Boulders
Air Temperature: 63-70ºF	Occurrence of Large Organic Debris: 0%
Dominant Bank Cover: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 87%	
Dominant Bank Substrate Cobble/Gravel	
Embeddedness Value: 1: 38% 2: 25% 3: 0% 4: 13% 5: 25%	

Two sites were electrofished on Box Canyon Creek in 2000. Both sites were sampled on October 27, 2000 by Glenn Yoshioka (CDFG), Gordon Johnson (CCC), Ben Beaver, and Kirsten Williams (WSP). The first site sampled included four habitat units. These units included a run, a low gradient riffle, mid-channel pool, and a plunge pool. The site yielded 22 juvenile steelhead rainbow trout and 1 juvenile coho salmon. Based on visually estimated lengths, the probable distribution of steelhead age classes was 20 age 0+ and 2 age 1+ juveniles. The second site sampled began 957 feet upstream from the mouth and included five habitat units. These units included a run, a low gradient riffle, a dammed pool, another dammed pool, and a plunge pool. The site yielded 13 juvenile steelhead rainbow trout. Based on visually estimated lengths, all of these juvenile steelhead trout appeared to be young-of-the-year (age 0+).

Eubank Creek

Eubank Creek is tributary to the Mattole River, located in Humboldt County, California. Eubank Creek's legal description at the confluence with the Mattole River is T04S R02E S30. Its location is 40°05'09" N. latitude and 123°59'55" W. longitude. Eubank Creek is a second order stream and has approximately 3.3 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. Eubank Creek drains a watershed of approximately 3.4 square miles. Summer base runoff is approximately 0.8 cubic feet per second (cfs) at the mouth, but over 20 cfs is not unusual during winter storms. Elevations range from about 720 feet at the mouth of the creek to 1,400 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is primarily used for rural residence. Vehicle access exists from the Briceland/Shelter Cove Road.

The habitat inventory of July 8 through 15, 1996, was conducted by Dave Smith and Ray Bevitori (PCFWWRA). The total length of the stream surveyed was 17,556 feet with no additional feet of side channel. Eubank Creek is a B1 channel type for the first 15,895 feet, and a B4 type for the remaining 1,661 feet of stream reach surveyed. B-type channels are moderately entrenched, moderate gradient (>2%), riffle dominated channels with infrequently spaced pools and very stable plan and profile. B1 channels are classified as predominantly bedrock; in B4 channels gravel is the dominant substrate.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/8/96 through 7/11/96
USGS Quad Map: Briceland   Latitude: 40º 5' 9"   Longitude: 123º 59' 55"

Stream Reach: 1	
Channel Type: B1	Canopy Density: 78%
Bankfull Width: 15 ft	Coniferous Component: 15%
Channel Length:15895 ft	Deciduous Component: 85%
Riffle/Flatwater Mean Width: 12 ft	Pools by Stream Length: 33%
Total Pool Mean Depth: 1 ft	Pools >= 3 ft Depth: 20%
Base Flow: 1.1 cfs	Mean Pool Shelter Rating: 58
Water Temperature: 57-68°F	Dominant Shelter: Boulders
Air Temperature: 61-85°F	Occurrence of Large Organic Debris: 6%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 81%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 43% 3: 57% 4: 0% 5: 0%	
Stream Reach: 2	
Channel Type: B4	Canopy Density: 86%
Bankfull Width: 18.8 ft	Coniferous Component: 50%
Channel Length:1661 ft	Deciduous Component: 50%
Riffle/Flatwater Mean Width: 40 ft	Pools by Stream Length: 34%
Total Pool Mean Depth: 0.7 ft	Pools >= 3 ft Depth: 17%
Base Flow: 1.1 cfs	Mean Pool Shelter Rating: 40
Water Temperature: 59-62°F	Dominant Shelter: Boulders
Air Temperature: 66-75°F	Occurrence of Large Organic Debris: 0%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 83%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 0% 3: 50% 4: 50% 5: 0%	

One site was electrofished on July 8, 1996, in Eubank Creek. The site was sampled by Ruth Goodfield (CDFG) and Kelley Garrett (AmeriCorps Watershed Stewards Project). The site sampled included habitat units 004-005, a riffle/run sequence, approximately 263 feet from the confluence with the Mattole River. This site had an area of 675 sq ft and a volume of 540 cu ft. The site yielded 11 steelhead young-of-the-year (YOY) and two steelhead 1+ years in age.

McKee Creek

McKee Creek is tributary to the Mattole River, located in Humboldt County, California. McKee Creek's legal description at the confluence with the Mattole River is T04S R02E S33. Its location is 40°03'44" North latitude and 123°57'50" West longitude. McKee Creek is a second order stream and has approximately 2.2 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. McKee Creek drains a watershed of approximately 2.1 square miles. Summer base flow is approximately 1.0 cubic feet per second (cfs) at the mouth, but over 25 cfs is not unusual during winter storms. Elevations range from about 900 feet at the mouth of the creek to 1,450 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is primarily managed for private rural residence. Vehicle access exists via Briceland Road from Redway to Thorn Junction.

The habitat inventory of July 3 through 15, 1996, was conducted by Rick Abbey and Mike Mezlin (PCFWWRA). The total length of the stream surveyed was 11,779 feet with an additional 87 feet of side channel. McKee Creek is a B3 channel type for the first 3,814 feet of stream reach surveyed, and an F4 channel type for the remaining 7,965 feet of surveyed stream. B3 channels are moderately entrenched, moderate gradient, riffle-dominated channels with cobble-dominant substrates. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/3/96 through 7/15/96
USGS Quad Map: Briceland Latitude: 40º 3' 44" Longitude: 123º 57' 50"

Stream Reach: 1

Channel Type: B3	Canopy Density: 80%
Bankfull Width: 14 ft	Coniferous Component: 11%
Channel Length:3814 ft	Deciduous Component: 89%
Riffle/Flatwater Mean Width: 10 ft	Pools by Stream Length: 38%
Total Pool Mean Depth: 0.8 ft	Pools >= 3 ft Depth: 11%
Base Flow: 1.1 cfs	Mean Pool Shelter Rating: 23
Water Temperature: 57-61°F	Dominant Shelter: Bedrock Ledges
Air Temperature: 62-72°F	Occurrence of Large Organic Debris: 8%
Dominant Bank Vegetation: Brush	Dry Channel: 0 ft
Vegetative Cover: 65%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 31% 2: 50% 3: 19% 4: 0% 5: 0%	

Stream Reach: 2

Channel Type: F4	Canopy Density: 87%
Bankfull Width: 10 ft	Coniferous Component: 6%
Channel Length:7965 ft	Deciduous Component: 94%
Riffle/Flatwater Mean Width: 8 ft	Pools by Stream Length: 25%
Total Pool Mean Depth: 1 ft	Pools >= 3 ft Depth: 3%
Base Flow: 1.1 cfs	Mean Pool Shelter Rating: 34
Water Temperature: 54-62°F	Dominant Shelter: Small Woody Debris
Air Temperature: 58-77°F	Occurrence of Large Organic Debris: 11%
Dominant Bank Vegetation: Brush	Dry Channel: 0 ft
Vegetative Cover: 72%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 11% 2: 62% 3: 27% 4: 0% 5: 0%	

Two sites were electrofished on July 1, 1996, in McKee Creek. The sites were sampled by Ruth Goodfield (CDFG) and Kelley Garrett (WSP/AmeriCorps). The first site sampled included habitat units 0024-0025, a riffle/pool sequence approximately 692 feet from the confluence with the Mattole River. This site had an area of 320 sq ft and a volume of 256 cu ft. The site yielded four young-of-the-year (YOY) steelhead rainbow trout. The second site included habitat units 0111-0112, a run/pool sequence located approximately 4,138 feet above the creek mouth. This site had an area of 350 sq ft and a volume of 283 cu ft. The site yielded three YOY steelhead rainbow trout.

McKee Creek Tributary #1

McKee Creek Tributary #1 is a tributary to McKee Creek, tributary to the Mattole River, tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). McKee Creek Tributary #1's legal description at the confluence with McKee Creek is T04S R02E S33. Its location is 40°04′19″ north latitude and 123°57′21″ west longitude. McKee Creek Tributary #1 is a first order stream and is an intermittent stream according to the USGS Briceland 7.5 minute quadrangle. McKee Creek Tributary #1 drains a watershed of approximately 0.2 square miles. Elevations range from about 1000 feet at the mouth of the creek to 1500 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is primarily managed for private rural residence. Vehicle access exists via Briceland Road from Redway to Thorn Junction.

The habitat inventory of July 9, 1996, was conducted by D. Allen and R. Abbey (AmeriCorps/WSP). The total length of the stream surveyed was 372 feet.

No channel type was taken on the McKee Creek Tributary #1.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/9/96 through 7/9/96
USGS Quad Map: Briceland Latitude: 40º 4' 19" Longitude: 123º 57' 21"

Stream Reach: 1	
Channel Type:	Canopy Density: 79%
Bankfull Width: ft	Coniferous Component: 8%
Channel Length:397 ft	Deciduous Component: 92%
Riffle/Flatwater Mean Width: 5 ft	Pools by Stream Length: 13%
Total Pool Mean Depth: 0.6 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 16
Water Temperature: 58-60ºF	Dominant Shelter: Undercut Banks
Air Temperature: 69-70ºF	Occurrence of Large Organic Debris: 0%
Dominant Bank Vegetation: Brush	Dry Channel: 0 ft
Vegetative Cover: 61%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 80% 3: 20% 4: 0% 5: 0%	

No biological sampling was conducted on the McKee Creek Tributary #1.

Painter Creek

Painter Creek is tributary to McKee Creek, tributary to the Mattole River, located in Humboldt County, California. Painter Creek's legal description at the confluence with the Mattole River is T04S R02E S33. Its location is 40°04'02" North latitude and 123°57'35" West longitude. Painter Creek is a first order stream and has approximately 1.6 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. Painter Creek drains a watershed of approximately 0.7 square miles. Summer base flow is approximately 0.2 cubic feet per second (cfs) at the mouth, but over 5 cfs is not unusual during winter storms. Elevations range from about 950 feet at the mouth of the creek to 1,200 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for private rural residence. Vehicle access exists via Briceland Road, approximately 1.9 miles east of Whitethorn Junction.

The habitat inventory of July 8, 1996, was conducted by Rick Abbey and Dave Smith (PCFWWRA). The total length of the stream surveyed was 1,616 feet with no additional feet of side channel. Painter Creek is an F4 channel type for the entire 1,616 feet of stream reach surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/8/96 through 7/8/96
USGS Quad Map: Briceland Latitude: 40º 4' 2" Longitude: 123º 57' 35"

Stream Reach: 1	
Channel Type: F4	Canopy Density: 71%
Bankfull Width: ft	Coniferous Component: 5%
Channel Length:1616 ft	Deciduous Component: 95%
Riffle/Flatwater Mean Width: 5 ft	Pools by Stream Length: 20%
Total Pool Mean Depth: 0.6 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 21
Water Temperature: 58-61ºF	Dominant Shelter: Bedrock Ledges
Air Temperature: 67-77ºF	Occurrence of Large Organic Debris: 8%
Dominant Bank Vegetation: Grass	Dry Channel: 50 ft
Vegetative Cover: 65%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 20% 2: 70% 3: 10% 4: 0% 5: 0%	

No biological sampling was conducted. Young-of-the-year (YOY) salmonids were observed from the stream banks by the surveyors.

Southern Subbasin
Unnamed Tributary to the Mattole River

The unnamed tributary to the Mattole River is a tributary to the upper Mattole River. The unnamed tributary to the Mattole River's legal description at the confluence with the upper Mattole River is T05S R02E S33. Its location is 39°58'25" north latitude and 123°57'13" west longitude. The unnamed tributary to the Mattole River is a first order intermittent stream according to the USGS Bear Harbor 7.5 minute quadrangles. The unnamed tributary to the Mattole River drains a watershed of approximately 1.0 square miles. Elevations range from about 1300 feet at the mouth of the creek to 1600 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production. Vehicle access exists from the Briceland-Shelter Cove Road from Thorn Junction via the Whitethorn Road through Whitethorn to Gibson Creek approximately 0.2 miles north of Whitethorn School.

The habitat inventory of September 9, 1996 was conducted by D. Smith and R. Bevitori (AmeriCorps/WSP). The total length of the stream surveyed was 909 feet.

No channel type was taken on the unnamed tributary to the Mattole River.

Survey Data:

Location of Stream Mouth:
Survey Dates: 9/9/96 through 9/9/96
USGS Quad Map: Briceland   Latitude: 39º 58' 25"   Longitude: 123º 57' 13"

Stream Reach: 1	
Channel Type:	Canopy Density: 93%
Bankfull Width: ft	Coniferous Component: 55%
Channel Length:909 ft	Deciduous Component: 45%
Riffle/Flatwater Mean Width: 3 ft	Pools by Stream Length: 21%
Total Pool Mean Depth: 1.4 ft	Pools >= 3 ft Depth: 20%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 130
Water Temperature: 54-55ºF	Dominant Shelter: Small Woody Debris
Air Temperature: 62-64ºF	Occurrence of Large Organic Debris: 13%
Dominant Bank Vegetation: Coniferous Trees	Dry Channel: 113
Vegetative Cover: 89%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 20% 3: 80% 4: 0% 5: 0%	

No biological sampling was conducted on the unnamed tributary to the Mattole River.

Bridge Creek

Bridge Creek is tributary to the Mattole River, located in Humboldt County, California. Bridge Creek's legal description at the confluence with the Mattole River is T04S R02E S33. Its location is 40°03'45" North latitude and 123°57'49" West longitude. Bridge Creek is a third order stream and has approximately 6.5 miles of blue line stream according to the USGS Briceland and Shelter Cove 7.5 minute quadrangles. Bridge Creek drains a watershed of approximately 4.2 square miles. Summer base flow is approximately 1.3 cubic feet per second (cfs) at the mouth, but over thirty cfs is not unusual during winter storms. Elevations range from about 900 feet at the mouth of the creek to 1800 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned, and parts are subdivided for rural residence. The remainder of the watershed is the Kings Range National Conservation Area, and is managed for recreation by the Bureau of Land Management. Vehicle access exists from Redway via the Briceland/Shelter Cove Road to Whitethorn junction.

The habitat inventory of June 17 through July 2, 1996, was conducted by Dylan Brown, Dave Smith, and Raymond Bevitori (PCFWWRA). The total length of the stream surveyed was 16,467 feet with an additional 113 feet of side channel. However, included in this distance are approximately 2,500 feet of habitat that was not surveyed due to denied access by a landowner. Bridge Creek is an F4 channel type for 13,967 feet of the entire 16,467 feet of stream reach surveyed. The 2,500 feet of stream not surveyed was also not channel typed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients (<2%), with high width/depth ratios and gravel-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 6/17/96 through 7/2/96
USGS Quad Map: Briceland   Latitude: 40º 3' 45"   Longitude: 123º 57' 49"

Stream Reach: 1	
Channel Type: F4	Canopy Density: 76%
Bankfull Width: ft	Coniferous Component: 60%
Channel Length:3951 ft	Deciduous Component: 40%
Riffle/Flatwater Mean Width: 15 ft	Pools by Stream Length: 37%
Total Pool Mean Depth: 2.2 ft	Pools >= 3 ft Depth: 85%
Base Flow: 1.3 cfs	Mean Pool Shelter Rating: 65
Water Temperature: 53-54°F	Dominant Shelter: Bedrock Ledges
Air Temperature: 56-64°F	Occurrence of Large Organic Debris: 2%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 87%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 50% 3: 50% 4: 0% 5: 0%	

Stream Reach: 2	
Channel Type:	Canopy Density: 0%
Bankfull Width: ft	Coniferous Component: 0%
Channel Length:2500 ft	Deciduous Component: 0%
Riffle/Flatwater Mean Width: 0 ft	Pools by Stream Length: 0%
Total Pool Mean Depth: 0 ft	Pools >= 3 ft Depth: 0%
Base Flow: 1.3 cfs	Mean Pool Shelter Rating: 0
Water Temperature: 53-53°F	Dominant Shelter: Undercut Banks
Air Temperature: 55-55°F	Occurrence of Large Organic Debris: 0%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 0%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 0% 3: 0% 4: 0% 5: 0%	

Stream Reach: 3	
Channel Type: F4	Canopy Density: 93%
Bankfull Width: ft	Coniferous Component: 2%
Channel Length:10016 ft	Deciduous Component: 98%
Riffle/Flatwater Mean Width: 12 ft	Pools by Stream Length: 24%
Total Pool Mean Depth: 1 ft	Pools >= 3 ft Depth: 13%
Base Flow: 1.3 cfs	Mean Pool Shelter Rating: 52
Water Temperature: 53-57°F	Dominant Shelter: Boulders
Air Temperature: 53-70°F	Occurrence of Large Organic Debris: 16%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 85%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 11% 3: 89% 4: 0% 5: 0%	

One site was electrofished on June 26, 1996, in Bridge Creek. The site was sampled by Ruth Goodfield (CDFG), Kelley Garrett, and Todd Kraemer (WSP/AmeriCorps). The site sampled included habitat units 0010-0011, a riffle/run sequence approximately 610 feet from the confluence with the Mattole River. This site had an area of 450 sq ft and a volume of 315 cu ft. The site yielded two steelhead young-of-the-year (YOY) and one coho salmon YOY.

West Fork Bridge Creek

West Fork Bridge Creek is tributary to Bridge Creek, tributary to the Mattole River, located in Humboldt County, California. West Fork Bridge Creek's legal description at the confluence with Bridge Creek is T05S RO2E S00. Its location is 40°02'41" North latitude and 123°59'32" West longitude. West Fork Bridge Creek is a second order stream and has approximately 3.0 miles of blue line stream according to the USGS Briceland and Shelter Cove 7.5 minute quadrangles. West Fork Bridge Creek drains a watershed of approximately 2.6 square miles. Summer base flow is approximately 0.4 cubic feet per second (cfs) at the mouth, but over 15 cfs is not unusual during winter storms. Elevations range from about 1,040 feet at the mouth of the creek to 1,600 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily Bureau of Land Management property and is managed for recreation. Vehicle access exists via the Briceland/Shelter Cove Road from Redway west to Whitethorn Junction.

The habitat inventory of June 24, 25, and 26, 1996, was conducted by Dave Smith and Ray Bevitori (PCFWWRA). The total length of the stream surveyed was 7,386 feet with no additional feet of side channel. West Fork Bridge Creek is a B4 channel type for the first 4,667 feet of stream surveyed and a C4 type for the remaining 2,719 of the survey. B4 channels are moderately entrenched, meandering, riffle dominated channels on moderate gradients with stable banks and gravel-dominant substrates. C4 channel types are low gradient, meandering, alluvial channels with well defined floodplains and gravel-dominant substrates.

<u>*Survey Data:*</u>

Location of Stream Mouth:
Survey Dates: 6/24/96 through 6/24/96
USGS Quad Map: Briceland   Latitude: 40º 2' 41"   Longitude: 123º 59' 32"

Stream Reach: 1

Channel Type: B4	Canopy Density: 76%
Bankfull Width: 17.1 ft	Coniferous Component: 36%
Channel Length:4667 ft	Deciduous Component: 64%
Riffle/Flatwater Mean Width: 13 ft	Pools by Stream Length: 19%
Total Pool Mean Depth: 1 ft	Pools >= 3 ft Depth: 13%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 55
Water Temperature: 51-56ºF	Dominant Shelter: Boulders
Air Temperature: 49-64ºF	Occurrence of Large Organic Debris: 14%
Dominant Bank Vegetation:	Coniferous Trees Dry Channel: 0 ft

Vegetative Cover: 82
Dominant Bank Substrate: Silt/Clay/Sand
Embeddedness Value: 1: 0% 2: 0% 3: 100% 4: 0% 5: 0%

Stream Reach: 2

Channel Type: C4	Canopy Density: 78%
Bankfull Width: 11.4 ft	Coniferous Component: 50%
Channel Length:2719 ft	Deciduous Component: 50%
Riffle/Flatwater Mean Width: 2 ft	Pools by Stream Length: 23%
Total Pool Mean Depth: 0.7 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 10

Water Temperature: 52-55ºF
Air Temperature: 51-65ºF
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover: 72%
Dominant Bank Substrate: Silt/Clay/Sand
Embeddedness Value: 1: 0% 2: 0% 3: 100% 4: 0% 5: 0%
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 28%
Dry Channel: 80 ft

Young-of-the-year (YOY) salmonids were observed from the streambank in West Fork Bridge Creek by the 1996 survey crew. No biological sampling was conducted.

South Branch of West Fork Bridge Creek

South Branch West Fork Bridge Creek is tributary to West Fork Bridge Creek, tributary to Bridge Creek, tributary to the Mattole River, located in Humboldt County, California. South Branch West Fork Bridge Creek's legal description at the confluence with the Mattole River is T05S R02E S00. Its location is 40°02'30" N. latitude and 123°59'29" W. longitude. South Branch West Fork Bridge Creek is a first order stream and has approximately 1.3 miles of blue line stream according to the USGS Briceland and Shelter Cove 7.5 minute quadrangles. The stream drains a watershed of approximately 1.1 square miles. Summer base flow is approximately 0.2 cubic feet per second (cfs) at the mouth, but over 10 cfs is not unusual during winter storms. Elevations range from about 1,080 feet at the mouth of the creek to 1,600 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for rural residence subdivision. Vehicle access exists from Redway via the Briceland/Shelter Cove Road to an unimproved road 1.7 miles west of Thorn Junction.

The habitat inventory of June 25, 26, and 27, 1996, was conducted by Dave Smith and Ray Bevitori (PCFWWRA). The total length of the stream surveyed was 7,456 feet with no additional feet of side channel. South Branch West Fork Bridge Creek is an F4 channel type for the entire 7,456 feet of stream reach surveyed. F4 channels are low gradient (<2%), entrenched, meandering streams with a gravel-dominant substrate.

Survey Data:

Location of Stream Mouth:
Survey Dates: 6/25/96 through 6/27/96
USGS Quad Map: Briceland Latitude: 40º 2' 30" Longitude: 123º 59' 29"

Stream Reach: 1
Channel Type: F4
Bankfull Width: 10 ft
Channel Length:7456 ft
Riffle/Flatwater Mean Width: 12 ft
Total Pool Mean Depth: 1.1 ft
Base Flow: 0 cfs
Water Temperature: 53-60ºF
Air Temperature: 53-64ºF
Dominant Bank Vegetation: Deciduous Trees
Vegetative Cover: 77%
Dominant Bank Substrate: Silt/Clay/Sand
Embeddedness Value: 1: 0% 2: 13% 3: 87% 4: 0% 5: 0%
Canopy Density: 73%
Coniferous Component: 21%
Deciduous Component: 79%
Pools by Stream Length: 18%
Pools >= 3 ft Depth: 10%
Mean Pool Shelter Rating: 58
Dominant Shelter: Small Woody Debris
Occurrence of Large Organic Debris: 20%
Dry Channel: 0 ft

The presence of young-of-the-year (YOY) salmonids was noted from streambank observations by the survey crew on South Branch West Fork Bridge Creek. No biological sampling was conducted.

Vanauken Creek

Vanauken Creek is tributary to the Mattole River, located in Humboldt County, California. Vanauken Creek's legal description at the confluence with the Mattole River is T05S R02E S--. Its location is 40°03'07" North latitude and 124°57'20" West longitude. Vanauken Creek is a second order stream and has approximately 2.6 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. Vanauken Creek drains a watershed of approximately 1.7 square miles. Summer base flow is approximately 0.5 cubic feet per second (cfs) at the mouth, but over 10 cfs is not unusual during winter storms. Elevations range from about 940 feet at the mouth of the creek to 1,600 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production. Vehicle access exists via Briceland Road to Whitethorn Junction.

The habitat inventory of June 10, 11, and 12, 1996, was conducted by Dave Smith and Dylan Brown (PCFWWRA). The total length of the stream surveyed was 7,456 feet with an additional 579 feet of side channel. Vanauken Creek is an F4 channel type for the first 7,456 feet of stream reach surveyed, and a G4 channel type for the remaining 579 feet of stream surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. G4 channels are entrenched "gully" step-pool types with low width/depth ratio on a moderate gradient and gravel-dominant substrate.

Survey Data:

Location of Stream Mouth:
Survey Dates: 6/10/96 through 6/12/96
USGS Quad Map: Briceland   Latitude: 40º 3' 7"   Longitude: 124º 57' 20"

Stream Reach: 1

Channel Type: F4	Canopy Density: 92%
Bankfull Width: 15.6 ft	Coniferous Component: 17%
Channel Length:7456 ft	Deciduous Component: 83%
Riffle/Flatwater Mean Width: 10 ft	Pools by Stream Length: 35%
Total Pool Mean Depth: 1.1 ft	Pools >= 3 ft Depth: 12%
Base Flow: 0.6 cfs	Mean Pool Shelter Rating: 64
Water Temperature: 50-54ºF	Dominant Shelter: Small Woody Debris
Air Temperature: 50-65ºF	Occurrence of Large Organic Debris: 9%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 91%	
Dominant Bank Substrate: Silt/Clay/Sand	

Embeddedness Value: 1: 5% 2: 19% 3: 75% 4: 1% 5: 0%

Stream Reach: 2

Channel Type: G4	Canopy Density: 0%
Bankfull Width: 13 ft	Coniferous Component: 12%

Channel Length:579 ft	Deciduous Component: 88%
Riffle/Flatwater Mean Width: 11 ft	Pools by Stream Length: 25%
Total Pool Mean Depth: 1.4 ft	Pools >= 3 ft Depth: 33%
Base Flow: 0.6 cfs	Mean Pool Shelter Rating: 23
Water Temperature: 54-55°F	Dominant Shelter: Small Woody Debris
Air Temperature: 60-62°F	Occurrence of Large Organic Debris: 13%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 90%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 17% 3: 83% 4: 0% 5: 0%	

Two sites were electrofished on June 26, 1996, in Vanauken Creek. The sites were sampled by Kelley Garrett and Todd Kraemer (WSP/AmeriCorps). The first site sampled included habitat units 0087-0089, a riffle/run/pool sequence approximately 3,382 feet from the confluence with the Mattole River. This site had an area of 800 sq ft and a volume of 640 cu ft. The site yielded one young-of-the-year (YOY) steelhead rainbow trout and one 1+ steelhead rainbow trout. The second site included habitat units 0095-0097, a riffle/run/pool sequence located approximately 3,620 feet above the creek mouth. This site had an area of 600 sq ft and a volume of 480 cu ft. The site yielded two YOY steelhead rainbow trout.

South Fork Vanauken Creek

South Fork Vanauken Creek is tributary to Vanauken Creek, tributary to Mattole River, located in Humboldt County, California. South Fork Vanauken Creeks's legal description at the confluence with Vanauken Creek is T05S R02W S--. Its location is 40N03'21" N. latitude and 123N56'50" W. longitude. South Fork Vanauken Creek is a blue line stream according to the USGS Briceland 7.5 minute quadrangle. South Fork Vanauken Creek drains a watershed of approximately 0.34 square miles. Elevations range from about 990 feet at the mouth of the creek to 1120 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production. Vehicle access exists via Briceland Road to Whitethorn Junction.

The habitat inventory of June 11, 1996, was conducted by Dave Smith and Dylan Brown (PCFWWRA). The total length of the stream surveyed was 449 feet. No channel type was taken on South Fork Vanauken Creek.

Survey Data:

Location of Stream Mouth:
Survey Dates: 6/11/96 through 6/11/96
USGS Quad Map: Briceland   Latitude: 40º 3' 21"   Longitude: 123º 56' 50"

Stream Reach: 1	
Channel Type:	Canopy Density: 90%
Bankfull Width: ft	Coniferous Component: 39%
Channel Length:449 ft	Deciduous Component: 61%
Riffle/Flatwater Mean Width: 5 ft	Pools by Stream Length: 35%
Total Pool Mean Depth: 1.2 ft	Pools >= 3 ft Depth: 29%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 79
Water Temperature: 55-55°F	Dominant Shelter: Large Woody Debris
Air Temperature: 63-64°F	Occurrence of Large Organic Debris: 27%

Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 90%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 0% 3: 71% 4: 29% 5: 0%	

No sites were electrofished on South Fork Vanauken Creek. Surveyors observed no fish for the 449' of the survey.

Anderson Creek

Anderson Creek is tributary to the Mattole River, located in Humboldt County, California. Anderson Creek's legal description at the confluence with the Mattole River is T05S R02E S00. Its location is 40°01′53″ north latitude and 123°57′17″ west longitude. Anderson Creek is a first order stream and has approximately 1.2 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. Anderson Creek drains a watershed of approximately 0.7 square miles. Elevations range from about 970 feet at the mouth of the creek to 1,800 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed mainly for rural residence. Vehicle access exists via Briceland Road west from Redway to Thorn Junction. Turn south at the junction and drive approximately three miles to the mouth of Anderson Creek.

The habitat inventory of September 28, 1998, was conducted by Stew McMorrow and Caroline Jezierski (WSP). The total length of the stream surveyed was 5,012 feet with no additional feet of side channel.

Anderson Creek is a B3 channel type for the entire 5,012 feet of stream reach surveyed. B3 channels are moderately entrenched, meandering, riffle/pool channels on 2-4% gradients with moderate width/depth ratios and cobble-dominant substrates. The suitability for fish habitat improvement stuctures is as follows: excellent for plunge weirs, boulder clusters and bank-placed boulders, single and opposing wing-deflectors, and log cover.

Survey Data:

Location of Stream Mouth:
Survey Dates: 9/28/98 through 9/28/98
USGS Quad Map: Briceland Latitude: 40º 1' 53" Longitude: 123º 57' 17"

Stream Reach: 1	
Channel Type: B3	Canopy Density: 88%
Bankfull Width: ft	Coniferous Component: 13%
Channel Length:5012 ft	Deciduous Component: 87%
Riffle/Flatwater Mean Width: 5 ft	Pools by Stream Length: 10%
Total Pool Mean Depth: 1.4 ft	Pools >= 3 ft Depth: 14%
Base Flow: 2.1 cfs	Mean Pool Shelter Rating: 19
Water Temperature: 54-55ºF	Dominant Shelter: Terrestrial Vegetation
Air Temperature: 57-64ºF	Occurrence of Large Organic Debris: 7%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 42 ft
Vegetative Cover: 88%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 2% 3: 45% 4: 0% 5: 9%	

One site was electrofished on July 1, 1996, in Anderson Creek. The site was sampled by Ruth Goodfield (CDFG) and Todd Kraemer (WSP). The site sampled included habitat units 0008-0010, a riffle/run/pool sequence located approximately 315 feet from the confluence with the Mattole River. This site had an area of 300 sq ft and a volume of 240 cu ft. The site yielded one young-of-the-year (YOY) coho salmon, three YOY steelhead rainbow trout, and one 1+ steelhead rainbow trout.

Mill Creek (R.M. 56.2)

Mill Creek (R.M. 56.2) the Mattole River, located in Humboldt County, California. Mill Creek's legal description at the confluence with the Mattole River is T05S R02E. Its location is 40°01'31" North latitude and 123°56'50" West longitude. Mill Creek is a second order stream and has approximately 2.4 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. Mill Creek drains a watershed of approximately 2.4 square miles. Summer base flow is approximately 0.3 cubic feet per second (cfs) at the mouth, but over five cfs is not unusual during winter storms. Elevations range from about 1,000 feet at the mouth of the creek to 1,400 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for rural residence. Vehicle access exists from the Briceland Road at Thorn Junction on the Whitethorn Road. Turn west on the unimproved road that crosses the Mattole River approximately 0.3 miles before the town of Whitethorn.

The habitat inventory of July 13, 1996, was conducted by Dave Smith and Ray Bevitori (PCFWWRA). The total length of the stream surveyed was 934 feet with no additional feet of side channel. Mill Creek is an F4 channel type for the entire 934 feet of stream reach surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/3/96 through 7/3/96
USGS Quad Map: Bear Harbor   Latitude: 40º 1' 31"   Longitude: 123º 56' 50"

Stream Reach: 1	
Channel Type: F4	Canopy Density: 95%
Bankfull Width: 16.5 ft	Coniferous Component: 9%
Channel Length:934 ft	Deciduous Component: 91%
Riffle/Flatwater Mean Width: 12 ft	Pools by Stream Length: 45%
Total Pool Mean Depth: 1.3 ft	Pools >= 3 ft Depth: 57%
Base Flow: 0.3 cfs	Mean Pool Shelter Rating: 50
Water Temperature: 57-57ºF	Dominant Shelter: Bubble Curtain
Air Temperature: 68-70ºF	Occurrence of Large Organic Debris: 0%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 86%	
Dominant Bank Substrate: Silt/Clay/Sand	

Embeddedness Value: 1: 0% 2: 67% 3: 33% 4: 0% 5: 0%

One site was electrofished on July 13, 1996, in Mill Creek. It was sampled by Ruth Goodfield (CDFG), Dave Smith, and Ray Bevitori (PCFWWRA). The site sampled included habitat units 001-003, a riffle/run/pool sequence, beginning approximately ten feet from the confluence with the Mattole River. This site had an area of 1200 sq ft and a volume of 960 cu ft. The site yielded seven young-of-the-year (YOY) steelhead rainbow trout, one 1+ steelhead rainbow trout, one threespine stickleback, and over 50 California roach.

Upper Mattole River

Upper Mattole River is part of the Mattole River system, located in Humboldt and Mendocino Counties, California. Upper Mattole River's legal description at the confluence with Gibson Creek is T05S R02E S--. Its location is 40°01'18" North latitude and 123°56'14" West longitude. Upper Mattole River is a third order stream and has approximately 5.4 miles of blue line stream according to the USGS Briceland and Bear Harbor 7.5 minute quadrangles. Upper Mattole River drains a watershed of approximately 12.8 square miles. Summer base flow is approximately 1.0 cubic feet per second (cfs) at its confluence with Gibson Creek, but over 20 cfs is not unusual during winter storms. Elevations range from about 980 feet at the mouth of the creek to 1,300 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production, rural residence, and hiking trails. Vehicle access exists from the Briceland-Shelter Cove Road from Thorn Junction via the Whitethorn Road through Whitethorn to Gibson Creek approximately 0.2 miles north of Whitethorn School.

The habitat inventory of August 28 to September 9, 1996, was conducted by Ray Bevitori and Dave Smith (PCFWWRA). The total length of the stream surveyed was 35,199 feet with an additional 517 feet of side channel. Upper Mattole River is an F3 channel type for the entire 35,199 feet of stream reach surveyed. F3 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and cobble-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 8/28/96 through 9/9/96
USGS Quad Map: Briceland Latitude: 40º 1' 18" Longitude: 123º 56' 14"

Stream Reach: 1	
Channel Type: F3	Canopy Density: 83%
Bankfull Width: 20 ft	Coniferous Component: 29%
Channel Length:35199 ft	Deciduous Component: 71%
Riffle/Flatwater Mean Width: 15 ft	Pools by Stream Length: 43%
Total Pool Mean Depth: 1.8 ft	Pools >= 3 ft Depth: 61%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 100
Water Temperature: 49-57ºF	Dominant Shelter: Small Woody Debris
Air Temperature: 46-67ºF	Occurrence of Large Organic Debris: 16%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 197
Vegetative Cover: 83%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 41% 3: 59% 4: 0% 5: 0%	

Young-of-the-year (YOY) and juvenile (1+) salmonids were observed from the streambanks during the 1996 summer survey of Upper Mattole River. No biological sampling was conducted.

Stanley Creek

Stanley Creek is a tributary to the Mattole River, located in Humboldt County, California. Stanley Creek's legal description at the confluence with Mattole River is T5S R2E S--. Its location is 40°01′01″ north latitude and 123°26′07″ west longitude. Stanley Creek is a first order stream and has approximately 2.03 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. Stanley Creek drains a watershed of approximately 0.86 square miles. Elevations range from about 1020 feet at the mouth of the creek to 1400 feet in the headwater areas. Redwood and Douglas fir forest dominate the watershed. The watershed is privately owned and managed for timber production and recreation. Vehicle access exists from U.S. Highway 101 at Redway via the Briceland Road to Thorn Junction. From Thorn Junction to Whitethorn, the creek is under the first bridge past the Whitethorn School.

The habitat inventory of June 14 and 15, 1999, was conducted by Donn Rehberg and Greg Larson (AmeriCorps/WSP). The total length of the stream surveyed was 5,076 feet.

Stanley Creek is an F4 channel type for the entire 5,076 feet of stream reach surveyed. F4 types are entrenched meandering riffle/pool gravel channels on low gradients with high width/depth ratio. The suitability of F4 channels for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover; and poor for boulder clusters.

Survey Data:

Location of Stream Mouth:
Survey Dates: 6/14/99 through 6/15/99
USGS Quad Map: Briceland   Latitude: 40º 1' 0"   Longitude: 123º 56' 7"

Stream Reach: 1	
Channel Type: F4	Canopy Density: 94%
Bankfull Width: 7.7 ft	Coniferous Component: 22%
Channel Length:5076 ft	Deciduous Component: 78%
Riffle/Flatwater Mean Width: 7 ft	Pools by Stream Length: 32%
Total Pool Mean Depth: 1.5 ft	Pools >= 3 ft Depth: 24%
Base Flow: 0.3 cfs	Mean Pool Shelter Rating: 16
Water Temperature: 52-54ºF	Dominant Shelter: Undercut Banks
Air Temperature: 52-70ºF	Occurrence of Large Organic Debris: 18%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 25 ft
Vegetative Cover: 99%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 6% 2: 43% 3: 19% 4: 11% 5: 22%	

One site was electrofished on October 1, 1999 in Stanley Creek. The site was sampled by Glenn Yoshioka and Paul Ferns (CDFG and AmeriCorps/WSP). Eleven mid-channel pools were sampled. These pools yielded 38 steelhead rainbow trout. Based on visually estimated lengths, the probable breakdown of steelhead age classes was 30 young of the year, 7 age 1+, and one age 2+ juveniles.

Baker Creek

Baker Creek is tributary to the Mattole River, located in Humboldt County, California. Baker Creek's legal description at the confluence with the Mattole River is T05S R02E. Its location is 40N00'29" N. latitude and 123N55'46" W. longitude. Baker Creek is a second order stream and has approximately 3.1 miles of blue line stream, according to the USGS Briceland 7.5 minute quadrangle. Baker Creek drains a watershed of approximately 1.6 square miles. Elevations range from about 1,020 feet at the mouth of the creek to 1,600 feet in the headwater areas. Douglas fir forest dominates the watershed. Approximately 90 percent of the watershed is privately owned and is managed for timber harvest. The lower ten percent is owned by California State Parks and Recreation, and is presently undeveloped. Vehicle access exists via the Briceland - Whitethorn Road.

The habitat inventory of August 18 through 30, 1994, was conducted by Ruth Goodfield and Will Abel (CCC). The total length of the stream surveyed was 11,852 feet, with an additional 303 feet of side channel. Baker Creek is an F4 channel type for the entire 11,852 feet of stream reach surveyed. F4 channels are entrenched meandering riffle/pool channels on low gradients (< 2%) with high width/depth ratios and gravel dominated substrate.

Survey Data:

Location of Stream Mouth:
Survey Dates: 8/29/94 through 8/30/94
USGS Quad Map: Briceland Latitude: 40º 0' 29" Longitude: 123º 55' 46"

Stream Reach: 1	
Channel Type: F4	Canopy Density: 99%
Bankfull Width: 7 ft	Coniferous Component: 18%
Channel Length:11852 ft	Deciduous Component: 82%
Riffle/Flatwater Mean Width: 5 ft	Pools by Stream Length: 26%
Total Pool Mean Depth: 0.2 ft	Pools >= 3 ft Depth: 2%
Base Flow: 0.1 cfs	Mean Pool Shelter Rating: 68
Water Temperature: 54-64ºF	Dominant Shelter: Small Woody Debris
Air Temperature: 54-82ºF	Occurrence of Large Organic Debris: 12%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 11 ft
Vegetative Cover: 78%	
Dominant Bank Substrate:	

Embeddedness Value: 1: 39% 2: 48% 3: 11% 4: 2% 5: %

One site was electrofished on August 24, 1994 in Baker Creek. The units were sampled by Ruth Goodfield and Will Abel (CCC). All measurements are fork lengths (FL) unless noted otherwise. The site sampled was habitat unit 035, a mid-channel pool, approximately 1,133 feet from the confluence with the Mattole River. This site had an area of 182 sq ft, and a volume of 110 cu ft. The unit yielded 22 steelhead, ranging from 43 to 106mm FL.

Thompson Creek

Thompson Creek is tributary to the Mattole River, located in Mendocino County, California. Thompson Creek's legal description at the confluence with the Mattole River is T05S R02E S--. Its location is 39°59'04" north latitude and 123°55'42" west longitude. Thompson Creek is a first order stream and has approximately 3.0 miles of blue line stream according to the USGS Bear Harbor and Briceland 7.5 minute quadrangles. Thompson Creek drains a watershed of approximately 3.6 square miles. Summer base runoff is approximately 2.5 cubic feet per second (cfs) at the mouth, but over 25 cfs is not unusual during winter storms. Elevations range from about 1,100 feet at the mouth of the creek to 1,500 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed as a forest preserve. Vehicle access exists via the Briceland/Shelter Cove Road from Redway to Whitethorn Junction.

The habitat inventory of June 10 through 20, 1996, was conducted by Rick Abbey and Ray Bevitori (PCFWWRA). The total length of the stream surveyed was 17,337 feet with an additional 122 feet of side channel. Thompson Creek is a B1 channel type for the first 8,257 feet, and an F1 channel type for the remaining 9,080 feet of stream reach surveyed. B1 channels are moderately entrenched, moderate gradient (2-4%), riffle dominated channels with infrequently spaced pools, stable banks, and predominantly bedrock substrate. F1 channels are entrenched, meandering riffle/pool channels on low gradients with predominantly bedrock substrate.

Survey Data:

Location of Stream Mouth:
Survey Dates: 6/10/96 through 6/20/96
USGS Quad Map: Bear Harbor   Latitude: 39º 59' 4"   Longitude: 123º 55' 42"

Stream Reach: 1	
Channel Type: B1	Canopy Density: 83%
Bankfull Width: 28.4 ft	Coniferous Component: 12%
Channel Length:8257 ft	Deciduous Component: 88%
Riffle/Flatwater Mean Width: 15 ft	Pools by Stream Length: 39%
Total Pool Mean Depth: 1.7 ft	Pools >= 3 ft Depth: 57%
Base Flow: 2.5 cfs	Mean Pool Shelter Rating: 36
Water Temperature: 52-59°F	Dominant Shelter: Small Woody Debris
Air Temperature: 52-70°F	Occurrence of Large Organic Debris: 8%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 83%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 56% 3: 42% 4: 2% 5: 0%	

Stream Reach: 2	
Channel Type: F1	Canopy Density: 91%
Bankfull Width: 24.9 ft	Coniferous Component: 2%
Channel Length:9080 ft	Deciduous Component: 98%
Riffle/Flatwater Mean Width: 10 ft	Pools by Stream Length: 40%
Total Pool Mean Depth: 1.2 ft	Pools >= 3 ft Depth: 24%
Base Flow: 2.5 cfs	Mean Pool Shelter Rating: 47
Water Temperature: 52-56°F	Dominant Shelter: Undercut Banks
Air Temperature: 54-67°F	Occurrence of Large Organic Debris: 13%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 75%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 14% 3: 83% 4: 3% 5: 0%	

Two sites were electrofished on June 18, 1996, in Thompson Creek. The sites were sampled by Todd Kraemer (AmeriCorps/WSP) and Ray Bevitori (PCFWWRA). The first site sampled included habitat unit 007, a run approximately 223 feet from the confluence with the

Mattole River. This site had an area of 1,100 sq ft and a volume of 880 cu ft. The site yielded four young-of-the-year (YOY) steelhead rainbow trout and one coho YOY. The second site included habitat units 330-331, a run/pool sequence located approximately 16,762 feet above the creek mouth. This site had an area of 600 sq ft and a volume of 520 cu ft. The site yielded five steelhead YOY and two coho YOY.

Yew Creek

Yew Creek is tributary to Thompson Creek, tributary to the Mattole River, located in Mendocino County, California. Yew Creek's legal description at the confluence with the Mattole River is T05S R02E S00. Its location is 39°59'54" North latitude and 123°55'49" West longitude. Yew Creek is a first order stream and has approximately 1.9 miles of ephemeral stream according to the USGS Bear Harbor 7.5 minute quadrangle. Yew Creek drains a watershed of approximately 0.8 square miles. Summer base flow is approximately 1.0 cubic feet per second (cfs) at the mouth, but over 15 cfs is not unusual during winter storms. Elevations range from about 1,060 feet at the mouth of the creek to 1,400 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for rural residence. Vehicle access exists via Whitethorn Road, south approximately 1.6 miles to Thompson Creek.

The habitat inventory of June 13, 1996, was conducted by Dave Smith and Dylan Brown (PCFWWRA). The total length of the stream surveyed was 3,444 feet. Yew Creek is a B4 channel type for the entire 3,444 feet of stream reach surveyed. B4 channels are moderately entrenched, moderate gradient, riffle-dominated channels with high width/depth ratios and gravel-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 6/13/96 through 6/16/96
USGS Quad Map: Bear Harbor Latitude: 39º 59' 54" Longitude: 123º 55' 49"

Stream Reach: 1	
Channel Type: B4	Canopy Density: 93%
Bankfull Width: ft	Coniferous Component: 21%
Channel Length:3444 ft	Deciduous Component: 79%
Riffle/Flatwater Mean Width: 11 ft	Pools by Stream Length: 33%
Total Pool Mean Depth: 1 ft	Pools >= 3 ft Depth: 16%
Base Flow: 1.1 cfs	Mean Pool Shelter Rating: 64
Water Temperature: 51-56ºF	Dominant Shelter: Terrestrial Vegetation
Air Temperature: 53-63ºF	Occurrence of Large Organic Debris: 7%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 90%	
Dominant Bank Substrate: Silt/Clay/Sand	

Embeddedness Value: 1: 0% 2: 22% 3: 78% 4: 0% 5: %

One site was electrofished on June 16, 1996, in Yew Creek. The site was sampled by Scott Downie and Ruth Goodfield (CDFG). The site sampled included habitat units 0016-0017, a riffle/run sequence approximately 774 feet from the confluence with Thompson Creek. This site had an area of 240 sq ft and a volume of 120 cu ft. The site yielded three young-of-the-year (YOY) coho salmon, two YOY steelhead rainbow trout, and one 1+ steelhead.

Helen Barnum Creek

Helen Barnum Creek is tributary to the Mattole River, located in Mendocino County, California. Helen Barnum Creek's legal description at the confluence with the Mattole River is T05S R02E S00 . Its location is 39°59'56" North latitude and 123°55'21" West longitude. Helen Barnum Creek is a first order stream and has approximately 1.6 miles of intermittent stream according to the USGS Bear Harbor and Briceland 7.5 minute quadrangles. Helen Barnum Creek drains a watershed of approximately 0.7 square miles. Summer base flow is approximately 0.5 cubic feet per second (cfs) at the mouth, but over 10 cfs is not unusual during winter storms. Elevations range from about 1,060 feet at the mouth of the creek to 1,400 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production. Vehicle access exists via the Briceland/Shelter Cove Road from Redway west to Thorn Junction, from Thorn Junction south past Whitethorn.

The habitat inventory of June 24 and 25, 1996, was conducted by Rick Abbey and Dave Allen (PCFWWRA). The total length of the stream surveyed was 5,012 feet with 0 feet of side channel. Helen Barnum Creek is an E4 channel type for the entire 5,012 feet of stream reach surveyed. E4 channels are low gradient (<2%), meandering, riffle/pool streams with very little deposition and gravel-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 6/24/96 through 6/25/96
USGS Quad Map: Humboldt Latitude: 39º 59' 36" Longitude: 123º 55' 21"

Stream Reach: 1	
Channel Type: E4	Canopy Density: 61%
Bankfull Width: 10.5 ft	Coniferous Component: 23%
Channel Length:5012 ft	Deciduous Component: 77%
Riffle/Flatwater Mean Width: 6 ft	Pools by Stream Length: 11%
Total Pool Mean Depth: 1.9 ft	Pools >= 3 ft Depth: 9%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 60
Water Temperature: 52-56ºF	Dominant Shelter: Whitewater
Air Temperature: 56-60ºF	Occurrence of Large Organic Debris: 13%
Dominant Bank Vegetation: Brush	Dry Channel: 0 ft
Vegetative Cover: 73%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 17% 2: 72% 3: 11% 4: 0% 5: 0%	

One site was electrofished on June 16, 1996, in Helen Barnum Creek. The site was sampled by Scott Downie and Ruth Goodfield (CDFG). The site sampled included habitat units 006-008, a riffle/run/pool sequence approximately 120 feet from the confluence with the Mattole River. This site had an area of 420 sq ft and a volume of 336 cu ft. The site yielded five young-of-the-year (YOY) steelhead and one 1+ steelhead.

Lost Man Creek

Lost Man Creek is tributary to the Mattole River, located in Mendocino County, California. Lost Man Creek's legal description at the confluence with the Mattole River is T05S R02E. Its location is 39°59'36" North latitude and 123°55'21" West longitude. Lost Man Creek is a first order stream and has approximately 1.5 miles of blue line stream according to the USGS Bear Harbor and Briceland 7.5 minute quadrangles. Lost Man Creek drains a watershed of approximately 1.3 square miles. Summer base flow is approximately .5 cubic feet per second (cfs) at the mouth, but over 10 cfs is not unusual during winter storms. Elevations range from about 1,060 feet at the mouth of the creek to 1,350 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production. Vehicle access exists via Whitethorn Road south past Our Lady of the Redwoods Abbey to the first bridge across the Mattole River.

The habitat inventory of June 25, 26, and 27, 1996, was conducted by Rick Abbey and Dave Smith (PCFWWRA). The total length of the stream surveyed was 6,112 feet with no additional feet of side channel. Lost Man Creek is an E4 channel type for the entire 6,112 feet of stream reach surveyed. E4 channels are low gradient, meandering riffle/pool channels with low width/depth ratios and gravel-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 6/25/96 through 7/27/96
USGS Quad Map: Bear Harbor   Latitude: 39º 59' 36"   Longitude: 123º 55' 21"

Stream Reach: 1

Channel Type: E4	Canopy Density: 81%
Bankfull Width: 13 ft	Coniferous Component: 21%
Channel Length:6112 ft	Deciduous Component: 79%
Riffle/Flatwater Mean Width: 8 ft	Pools by Stream Length: 17%
Total Pool Mean Depth: 1.2 ft	Pools >= 3 ft Depth: 19%
Base Flow: 1 cfs	Mean Pool Shelter Rating: 32
Water Temperature: 52-58ºF	Dominant Shelter: Small Woody Debris
Air Temperature: 54-72ºF	Occurrence of Large Organic Debris: 6%
Dominant Bank Vegetation: Brush	Dry Channel: 0 ft
Vegetative Cover: 83%	
Dominant Bank Substrate: Silt/Clay/Sand	

Embeddedness Value: 1: 14% 2: 83% 3: 3% 4: 0% 5: 0%

Two sites were electrofished on June 16, 1996, in Lost Man Creek. The sites were sampled by Scott Downie and Ruth Goodfield (CDFG). The first site sampled included habitat units 004-005, a run\pool sequence approximately 138 feet from the confluence with the Mattole River. This site had an area of 700 sq ft and a volume of 560 cu ft. The site yielded two young-of-the-year (YOY) steelhead rainbow trout, and one 1+ steelhead rainbow trout. The second site included habitat units 0070-0071, a run/pool sequence located approximately 3,677 feet above the creek mouth. This site had an area of 1,000 sq ft and a volume of 800 cu ft. The site yielded three YOY and one 1+ steelhead rainbow trout.

Lost Man Creek Tributary #1

Unnamed tributary to Lost Man Creek is tributary to Lost Man Creek, tributary to the Mattole River, located in Humboldt County, California. Unnamed Tributary to Lost Man Creek's legal description at the confluence with Lost Man Creek is T05S R02E. Its location is 39N59'24" N. latitude and 123N54'55" W. longitude. Unnamed Tributary to Lost Man Creek is an ephemeral stream according to the USGS Bear Harbor 7.5 minute quadrangle.

Unnamed Tributary to Lost Man Creek drains a watershed of approximately 0.7 square miles. Summer base runoff is approximately .5 cubic feet per second (cfs) at the mouth. Elevations range from about 1,100 feet at the mouth of the creek to 1,260 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production. Vehicle access exists via Whitethorn Road south, to the bridge that crosses the Mattole River just past the Our Lady of the Redwoods Abbey.

The habitat inventory of June 27 to July 3, 1996, was conducted by Rick Abbey and Dave Smith (PCFFWRA). The total length of the stream surveyed was 6,558 feet with an additional 206 feet of side channel. Unnamed Tributary to Lost Man Creek is an E4 channel type for the entire 6,558 feet of stream surveyed. E4 channels are low gradient, meandering riffle/pool channels with low width/depth ratios and gravel-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 6/27/96 through 7/3/96
USGS Quad Map: Bear Harbor Latitude: 39º 59' 24" Longitude: 123º 54' 55"

Stream Reach: 1	
Channel Type: E4	Canopy Density: 83%
Bankfull Width: ft	Coniferous Component: 16%
Channel Length: 6558 ft	Deciduous Component: 84%
Riffle/Flatwater Mean Width: 7 ft	Pools by Stream Length: 44%
Total Pool Mean Depth: 1 ft	Pools >= 3 ft Depth: 14%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 45
Water Temperature: 52-56°F	Dominant Shelter: Small Woody Debris
Air Temperature: 57-76°F	Occurrence of Large Organic Debris: 19%
Dominant Bank Vegetation: Brush	Dry Channel: 0 ft
Vegetative Cover: 79%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 39% 2: 31% 3: 20% 4: 9% 5: 0%	

No sites were electrofished during the stream habitat survey of June 27 to July 3, 1996, in Unnamed Tributary to Lost Man Creek. Steelhead rainbow trout were observed from the stream banks by the surveyors.

Western Subbasin
Mill Creek (R.M. 2.8)

Mill Creek (R.M. 2.8) is tributary to the Mattole River, located in Humboldt County, California. Mill Creek's legal description at the confluence with the Mattole River is T02S R02W S16. Its location is 40°07'54" North latitude and 124°18'21" West longitude. Mill Creek is a second order stream and has approximately 2.0 miles of blue line stream according to the USGS Petrolia 7.5 minute quadrangle. Mill Creek drains a watershed of approximately 2.1 square miles. Summer base flow is approximately 0.3 cubic feet per second (cfs) at the mouth, but over 15 cfs is not unusual during winter storms. Elevations range from about 60 feet at the mouth of the creek to 1,200 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for rural residence. Vehicle access exists via Honeydew Road to the town of Petrolia.

The habitat inventory of July 16 and 17, 1996, was conducted by Rick Abbey and Ken Graves (PCFWWRA). The total length of the stream surveyed was 5,805 feet with an additional 179 feet of side channel. Mill Creek is a B2 channel type for the entire 5,805 feet of stream reach surveyed. B2 channels are moderately entrenched, moderate gradient, riffle dominated channels with stable banks and boulder-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/16/96 through 7/17/96
USGS Quad Map: Petrolia Latitude: 40º 17' 54" Longitude: 124º 18' 21"

Stream Reach: 1	
Channel Type: B2	Canopy Density: 82%
Bankfull Width: 11 ft	Coniferous Component: 6%
Channel Length:5805 ft	Deciduous Component: 94%
Riffle/Flatwater Mean Width: 13 ft	Pools by Stream Length: 24%
Total Pool Mean Depth: 1.1 ft	Pools >= 3 ft Depth: 10%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 40
Water Temperature: 55-58ºF	Dominant Shelter: Bubble Curtain
Air Temperature: 54-64ºF	Occurrence of Large Organic Debris: 6%
Dominant Bank Vegetation: Brush	Dry Channel: 0 ft
Vegetative Cover: 84%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 1% 2: 51% 3: 44% 4: 4% 5: 0%	

One site was electrofished on July 1, 1996, in Mill Creek. The sites were sampled by Todd Kraemer and Kelley Garrett (WSP/AmeriCorps). The site sampled included habitat units 002-003, a run/pool sequence approximately 300 feet from the confluence with the Mattole River. This site had an area of 650 sq ft and a volume of 720 cu ft. The site yielded one young-of-the-year (YOY) steelhead rainbow trout and one YOY coho salmon.

Mill Creek (RM 2.8) Tributary #1

Mill Creek (RM 2.8) Tributary #1 is tributary to Mill Creek (RM 2.8), tributary to the Mattole River, located in Humboldt County, California. Mill Creek (RM 2.8) Tributary #1's legal description at the confluence with Mill Creek (RM 2.8) is T02S R02W S16. Its location is 40°17'28" north latitude and 124°17'52" west longitude. Mill Creek (RM 2.8) Tributary #1 is a first order stream and has approximately 0.9 miles of blue line stream according to the USGS Petrolia 7.5 minute quadrangle. Mill Creek (RM 2.8) Tributary #1 drains a watershed of approximately 0.5 square miles. Elevations range from about 480 feet at the mouth of the creek to 800 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for rural residence. Vehicle access exists via Honeydew Road to the town of Petrolia.

The habitat inventory of July 17, 1996, was conducted by Rick Abbey and Ken Graves (PCFWWRA). The total length of the stream surveyed was 808 feet with no side channel. Mill Creek (RM 2.8) Tributary #1 is an A2 channel type for the entire 808 feet of stream reach surveyed. A2 channel types are steep, narrow, cascading step-pool streams with high energy/debris transport associated with depositional soils.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/17/1996 through 7/17/1996
USGS Quad Map: Petrolia Latitude: 40º 17' 28" Longitude: 124º 17' 52"

Stream Reach: 1	
Channel Type: A2	Canopy Density: 80%
Bankfull Width: ft	Coniferous Component: 11%
Channel Length:808 ft	Deciduous Component: 89%
Riffle/Flatwater Mean Width: 7 ft	Pools by Stream Length: 12%
Total Pool Mean Depth: 0.8 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 42
Water Temperature: 55-55ºF	Dominant Shelter: Whitewater
Air Temperature: 58-60ºF	Occurrence of Large Organic Debris: 6%
Dominant Bank Cover: Grass	Dry Channel: 0 ft
Vegetative Cover: 88%	
Dominant Bank Substrate Silt/Clay/Sand	
Embeddedness Value: 1: 0% 2: 71% 3: 29% 4: 0% 5: %	

No sites were electrofished during the stream habitat survey of July 17, 1996 in Mill Creek (RM 2.8) Tributary #1.

Mill Creek (RM 2.8) Tributary #2

Mill Creek (RM 2.8) Tributary #2 is tributary to Mill Creek (RM 2.8) Tributary #1, tributary to Mill Creek (RM 2.8), tributary to the Mattole River, located in Humboldt County, California. Mill Creek (RM 2.8) Tributary #2's legal description at the confluence with Mill Creek (RM 2.8) Tributary #1 is T02S R02W S16. Its location is 40°17'26" north latitude and 124°17'35" west longitude. Mill Creek (RM 2.8) Tributary #2 is a first order stream and has approximately 0.4 miles of blue line stream according to the USGS Petrolia 7.5 minute quadrangle. Mill Creek (RM 2.8) Tributary #2 drains a watershed of approximately 0.3 square miles. Elevations range from about 580 feet at the mouth of the creek to 680 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for rural residence. Vehicle access exists via Honeydew Road to the town of Petrolia.

The habitat inventory of July 17, 1996, was conducted by Rick Abbey and Ken Graves (PCFWWRA). The total length of the stream surveyed was 175 feet with no side channel. Mill Creek (RM 2.8) Tributary #2 is an A2 channel type for the entire 175 feet of stream reach surveyed. A2 channel types are steep, narrow, cascading step-pool streams with high energy/debris transport associated with depositional soils.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/17/1996 through 7/17/1996
USGS Quad Map: Petrolia Latitude: 40º 17' 26" Longitude: 124º 17' 35"

Stream Reach: 1	
Channel Type: A2	Canopy Density: 83%
Bankfull Width: ft	Coniferous Component: 0%
Channel Length:175 ft	Deciduous Component: 100%
Riffle/Flatwater Mean Width: 3 ft	Pools by Stream Length: 26%

Total Pool Mean Depth: 0.6 ft
Base Flow: 0 cfs
Water Temperature: 56-56°F
Air Temperature: 60-60°F
Dominant Bank Cover: Grass
Vegetative Cover: 80%
Dominant Bank Substrate Silt/Clay/Sand
Embeddedness Value: 1: 33% 2: 33% 3: 33% 4: 0% 5: %

Pools >= 3 ft Depth: 0%
Mean Pool Shelter Rating: 5
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 0%
Dry Channel: 0 ft

No sites were electrofished during the stream habitat survey of July 17, 1996 in Mill Creek (RM 2.8) Tributary #2.

Squaw Creek

Squaw Creek is tributary to the Mattole River, located in Humboldt County, California (Figure 1). The legal description at the confluence with the Mattole River is T2S R1W S30. Its location is 40°16'08" N. latitude and 124°13'32" W. longitude. Squaw Creek is a third order stream and has approximately 22.0 miles of blue line stream, according to the USGS Buckeye Mountain, Shubrick Peak, Petrolia, and Cooskie Creek 7.5 minute quadrangles. Squaw Creek and its tributaries drain a basin of approximately 16.7 square miles. Elevations range from about 160 feet at the mouth of the creek to 2,000 feet in the headwater areas. Douglas fir forest and oak grassland dominates the watershed. The watershed is privately owned and is managed for timber production and grazing. Year round vehicle access exists from U.S. Highway 101 at Dyerville, via the Bull Creek Road.

The habitat inventory of September 10, 15, 17, 22, and 24, 1992, was conducted by Erick Elliot and Brian Humphrey (CCC). The total length of the stream surveyed was 21,506 feet, with an additional 811 feet of side channel. Squaw Creek is an F3 channel type for the entire 21,443 feet of stream reach surveyed. F3 channels are low gradient, very well confined streams, with cobble dominated substrate.

Survey Data:

Location of Stream Mouth:
Survey Dates: 9/10/92 through 9/24/92
USGS Quad Map: Buckeye Mountain Latitude: 40º 16' 8" Longitude: 124º 13' 32"

Stream Reach: 1
Channel Type: F3
Bankfull Width: ft
Channel Length:22443 ft
Riffle/Flatwater Mean Width: 0 ft
Total Pool Mean Depth: 0 ft
Base Flow: 0 cfs
Water Temperature: 57-66°F
Air Temperature: 50-73°F
Dominant Bank Vegetation: Deciduous Trees
Vegetative Cover: 0%
Dominant Bank Substrate: Bedrock
Embeddedness Value: 1: 0% 2: 19% 3: 38% 4: 43% 5: 0%

Canopy Density: 0%
Coniferous Component: 43%
Deciduous Component: 80%
Pools by Stream Length: 20%
Pools >= 3 ft Depth: 0%
Mean Pool Shelter Rating: 42
Dominant Shelter: Bedrock Ledges
Occurrence of Large Organic Debris: 0%
Dry Channel: 0 ft

Three sites were electrofished on September 29, 1992 in Squaw Creek. The units were sampled by Erick Elliot and Brian Humphrey (CCC). All measurements are fork lengths unless noted otherwise. The first site sampled was habitat unit 017, a bedrock formed lateral scour pool, approximately 966 feet from the confluence with the Mattole River, and 250 feet downstream from the private steel bridge. The site had an area of 1,040 sq ft, and a volume of 2,496 cu ft. The sample included 11 steelhead, ranging from 70 to 164mm; 7 sculpin, ranging from 61 to 95mm; and 1 stickleback, 30mm. The second sample site was habitat unit 126, a run, approximately 9,192 above the confluence with the Mattole River, and 100 feet upstream from a road crossing. This site had an area of 2,323 sq ft, and a volume of 2,091 cu ft. The sample included 36 steelhead, ranging from 63 to 155mm; 8 stickleback, ranging from 33 to 40mm; and 1 roach, 113mm. The third site was habitat unit 179, a run, approximately 14,041 feet from the confluence with the Mattole River and just above the private foot bridge above the brown cabin. This site had an area of 1,168 sq ft, and a volume of 935 cu ft. The sample included 37 steelhead, ranging from 57 to 149mm; 5 sculpin, ranging from 63 to 79mm; 3 stickleback, ranging from 33 to 41mm; and 3 Pacific lamprey ammocetes, which were not measured.

Woods Creek

Woods Creek is tributary to the Mattole River, tributary to the Pacific Ocean, located in Humboldt County, California. Woods Creek's legal description at the confluence with Mattole River is T 3S R 1W S 2. Its location is 40°13'52" north latitude and 124°08'54" west longitude. Woods Creek is a first order stream and has approximately 1.2 miles of blue line stream according to the USGS Shubrick Peak 7.5 minute quadrangle. Woods Creek drains a watershed of approximately 1.9 square miles. Elevations range from about 70 feet at the mouth of the creek to 1700 feet in the headwater areas. Douglas fir forest and oak grassland dominate the watershed. The watershed is entirely privately owned and is managed for rangeland and homesteads. Vehicle access exists from U.S. Highway 101 South at the South Fork/ Honeydew exit. Follow the Mattole Road to Honeydew. At Honeydew the road forks, continue on the Mattole Road (right fork). About 1.8 miles after Honeydew, woods Creek will pass under the Mattole Road.

The habitat inventory of June 15, 16, and 17, 1999, was conducted by D. Rehberg and G. Larson (AmeriCorps/WSP). The total length of the stream surveyed was 9,893 feet with an additional 393 feet of side channel. Woods Creek is a F4 channel type for the first 6,415 feet and a B4 channel type for the next 3,478 feet of the stream reach surveyed. F4 channels are entrenched meandering riffle/pool gravel channels on low gradients with high width/depth ratio. B4 channels are moderately entrenched, moderate gradient, riffle dominated gravel channels with infrequently spaced pools, very stable plan and profile, and stable banks.

<u>Survey Data:</u>

Location of Stream Mouth:

Survey Dates: 6/15/1999 through 6/17/1999

USGS Quad Map: Shubrick Peak Latitude: 40º 13' 52" Longitude: 124º 8' 54"

Stream Reach: 1	
Channel Type: F4	Canopy Density: 60%
Bankfull Width: 18.2 ft	Coniferous Component: 14%
Channel Length:6415 ft	Deciduous Component: 86%
Riffle/Flatwater Mean Width: 12 ft	Pools by Stream Length: 5%
Total Pool Mean Depth: 1.8 ft	Pools >= 3 ft Depth: 13%

Base Flow: 2 cfs	Mean Pool Shelter Rating: 48
Water Temperature: 55-62ºF	Dominant Shelter: Boulders
Air Temperature: 55-73ºF	Occurrence of Large Organic Debris: 7%
Dominant Bank Substrate Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 67%	
Dominant Bank Cover: Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 73% 3: 13% 4: 0% 5: 13%	
Stream Reach: 2	
Channel Type: B4	Canopy Density: 72%
Bankfull Width: 23.3 ft	Coniferous Component: 23%
Channel Length:3478 ft	Deciduous Component: 77%
Riffle/Flatwater Mean Width: 8 ft	Pools by Stream Length: 5%
Total Pool Mean Depth: 1.6 ft	Pools >= 3 ft Depth: 22%
Base Flow: 2 cfs	Mean Pool Shelter Rating: 60
Water Temperature: 53-57ºF	Dominant Shelter: Boulders
Air Temperature: 59-73ºF	Occurrence of Large Organic Debris: 4%
Dominant Bank Cover: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 80%	
Dominant Bank Substrate Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 13% 3: 50% 4: 0% 5: 38%	

Two sites were electrofished on September 28 and 30, 1999 in Woods Creek. The sites were sampled by Glenn Yoshioka, Paul Ferns, and Donn Rehberg (CDFG and AmeriCorps). The first site was sampled on September 28 and 30, 1999. One run, one plunge pool, and 10 mid-channel pools were sampled in this F4 channel. The site yielded 194 juvenile steelhead rainbow trout. The probable breakdown of steelhead age classes is: 158 age 0+, 27 age 1+, 7 age 2+, 2 age 3+ juveniles. The second site was sampled on September 30, 1999. One riffle, one run, one lateral scour pool-root wad enhanced, and 9 mid-channel pools were sampled in this B4 channel type. The site yielded 144 juvenile steelhead rainbow trout. The probable breakdown of steelhead age classes is: 109 age 0+, 27 age 1+, 7 age 2+, 1 age 3+ juveniles.

Honeydew Creek

Honeydew Creek is tributary to the Mattole River, located in Humboldt County, California. Honeydew Creek's legal description at the confluence with the Mattole River is T03S R01E S06. Its location is 40°14'11" North latitude and 124°06'57" West longitude. Honeydew Creek is a third order stream and has approximately 14.7 miles of blue line stream according to the USGS Honeydew and Shubrick Peak 7.5 minute quadrangles. Honeydew Creek drains a watershed of approximately 17.2 square miles. Summer base flow is approximately six cubic feet per second (cfs) at the mouth, but over 30 cfs is not unusual during winter storms. Elevations range from about 350 feet at the mouth of the creek to 2,100 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily Bureau of Land Management property and is managed for diverse recreation. Vehicle access exists via Wilder Ridge Road.

The habitat inventory of July 22 to 29, 1996, was conducted by Dave Smith and Ray Bevitori (PCFWWRA). The total length of the stream surveyed was 23,178 feet with an additional 1,784 feet of side channel. Honeydew Creek is an F4 channel type for the first 13,505 feet of stream reach surveyed, an F3 for the next 5,877 feet, and a B2 for the final 3,796 feet of stream surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. An F3 channel is similar to an F4, but with cobble-dominant substrates. B2 channel types are moderately entrenched, moderate gradient streams, with stable banks and a predominantly boulder substrate.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/22/96 through 7/29/96
USGS Quad Map: Honeydew Latitude: 40º 14' 11" Longitude: 124º 6' 57"

Stream Reach: 1

Channel Type: F4	Canopy Density: 29%
Bankfull Width: 80 ft	Coniferous Component: 0%
Channel Length:7575 ft	Deciduous Component: 100%
Riffle/Flatwater Mean Width: 28 ft	Pools by Stream Length: 24%
Total Pool Mean Depth: 2.7 ft	Pools >= 3 ft Depth: 91%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 51
Water Temperature: 63-73ºF	Dominant Shelter: Whitewater
Air Temperature: 76-82ºF	Occurrence of Large Organic Debris: 6%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 41%	
Dominant Bank Substrate: Cobble/Gravel	

Embeddedness Value: 1: 0% 2: 27% 3: 73% 4: 0% 5: 0%

Stream Reach: 2

Channel Type: HT	Canopy Density: 0%
Bankfull Width: ft	Coniferous Component: 0%
Channel Length:1425 ft	Deciduous Component: 0%
Riffle/Flatwater Mean Width: 0 ft	Pools by Stream Length: 0%
Total Pool Mean Depth: 0 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 0
Water Temperature: 73-73ºF	Dominant Shelter:
Air Temperature: 81-81ºF	Occurrence of Large Organic Debris: 0%
Dominant Bank Vegetation:	Dry Channel: 0 ft
Vegetative Cover: 0%	
Dominant Bank Substrate:	

Embeddedness Value: 1: 0% 2: 0% 3: 0% 4: 0% 5: 0%

Stream Reach: 3

Channel Type: F4	Canopy Density: 48%
Bankfull Width: 80 ft	Coniferous Component: 1%
Channel Length:4505 ft	Deciduous Component: 99%
Riffle/Flatwater Mean Width: 18 ft	Pools by Stream Length: 19%
Total Pool Mean Depth: 2.3 ft	Pools >= 3 ft Depth: 89%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 61
Water Temperature: 58-67ºF	Dominant Shelter: Boulders
Air Temperature: 59-77ºF	Occurrence of Large Organic Debris: 1%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 55%	
Dominant Bank Substrate: Cobble/Gravel	

Embeddedness Value: 1: 0% 2: 33% 3: 67% 4: 0% 5: 0%

Stream Reach: 4
Channel Type: F3
Bankfull Width: 23 ft
Channel Length:5877 ft
Riffle/Flatwater Mean Width: 20 ft
Total Pool Mean Depth: 2 ft
Base Flow: 0 cfs
Water Temperature: 59-65°F
Air Temperature: 64-76°F
Dominant Bank Vegetation: Deciduous Trees
Vegetative Cover: 65%
Dominant Bank Substrate: Cobble/Gravel
Embeddedness Value: 1: 0% 2: 17% 3: 83% 4: 0% 5: 0%
Canopy Density: 77%
Coniferous Component: 6%
Deciduous Component: 94%
Pools by Stream Length: 14%
Pools >= 3 ft Depth: 77%
Mean Pool Shelter Rating: 92
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 0%
Dry Channel: 0 ft

Stream Reach: 5
Channel Type: A2
Bankfull Width: 30 ft
Channel Length:3796 ft
Riffle/Flatwater Mean Width: 19 ft
Total Pool Mean Depth: 1.5 ft
Base Flow: 0 cfs
Water Temperature: 59-63°F
Air Temperature: 68-78°F
Dominant Bank Vegetation: Deciduous Trees
Vegetative Cover: 61%
Dominant Bank Substrate: Cobble/Gravel
Embeddedness Value: 1: 0% 2: 17% 3: 83% 4: 0% 5: 0%
Canopy Density: 64%
Coniferous Component: 36%
Deciduous Component: 64%
Pools by Stream Length: 10%
Pools >= 3 ft Depth: 38%
Mean Pool Shelter Rating: 63
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 0%
Dry Channel: 0 ft

One site was electrofished on September 17, 1996, in Honeydew Creek. The site was sampled by Ruth Goodfield (CDFG) and Dale Melton (WSP/AmeriCorps). The site sampled included habitat units 0022-0023, a riffle/run sequence approximately 2,510 feet from the confluence with the Mattole River. This site had an area of 700 sq ft and a volume of 692 cu ft. The site yielded four young-of-the-year (YOY) steelhead rainbow trout, two 1+ steelhead rainbow trout, and one sculpin.

Bear Trap Creek

Bear Trap Creek is tributary to Honeydew Creek, tributary to the Mattole River, located in Humboldt County, California. Bear Trap Creek's legal description at the confluence with Honeydew Creek is T03S R01E S06. Its location is 40°15'36" North latitude and 124°06'03" West longitude. Bear Trap Creek is a first order stream and has approximately 2.7 miles of blue line stream according to the USGS Honeydew and Shubrick Peak 7.5 minute quadrangles. Bear Trap Creek drains a watershed of approximately 1.7 square miles. Summer flow is approximately 0.1 cubic feet per second (cfs) at the mouth, but over ten cfs is not unusual during winter storms. Elevations range from about 320 feet at the mouth of the creek to 1,100 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is subdivided for rural residence. Vehicle access exists via the Shelter Cove Road from Redway to the Honeydew Road on Wilder Ridge.

The habitat inventory of August 5 and 6, 1996, was conducted by Dave Smith and Ray Bevitori (PCFWWRA). The total length of the stream surveyed was 9,883 feet with an additional 708 feet of side channel. Bear Trap Creek is a B2 channel type for the entire 9,883 feet of stream reach surveyed. B2 channels are moderately entrenched, meandering, riffle/pool channels on moderate gradients with stable banks and boulder-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/5/96 through 8/6/96
USGS Quad Map: Honeydew   Latitude: 40º 13' 56" Longitude: 124º 6' 3"

Stream Reach: 1
Channel Type: B2
Bankfull Width: 19 ft
Channel Length:9883 ft
Riffle/Flatwater Mean Width: 10 ft
Total Pool Mean Depth: 1 ft
Base Flow: 0 cfs
Water Temperature: 56-72ºF
Air Temperature: 60-76ºF
Dominant Bank Vegetation: Deciduous Trees
Vegetative Cover: 70%
Dominant Bank Substrate: Silt/Clay/Sand
Embeddedness Value: 1: 0% 2: 8% 3: 92% 4: 0% 5: 0%

Canopy Density: 66%
Coniferous Component: 19%
Deciduous Component: 81%
Pools by Stream Length: 16%
Pools >= 3 ft Depth: 7%
Mean Pool Shelter Rating: 71
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 8%
Dry Channel: 638

One site was electrofished on September 17, 1996, in Bear Trap Creek. The site was sampled by Ruth Goodfield (CDFG) and Dale Melton (WSP/AmeriCorps). The site sampled included habitat units 009-011, a riffle/run/pool sequence, approximately 982 feet from the confluence with the Honeydew Creek. This site had an area of 560 sq ft and a volume of 392 cu ft. The site yielded thirty young-of-the-year (YOY) steelhead rainbow trout, and four stickleback.

Upper North Fork Honeydew Creek

Upper North Fork of Honeydew Creek is tributary to Honeydew Creek, tributary to the Mattole River, located in Humboldt County, California. Upper North Fork of Honeydew Creek's legal description at the confluence with Honeydew Creek is T03S R01W S13. Its location is 40°12'21" North latitude and 124°07'11" West longitude. Upper North Fork of Honeydew Creek is a first order stream and has approximately 5.3 miles of blue line stream according to the USGS Honeydew 7.5 minute quadrangle. Upper North Fork of Honeydew Creek drains a watershed of approximately 5.3 square miles. Summer base flow is approximately 0.5 cubic feet per second (cfs) at the mouth, but over ten cfs is not unusual during winter storms. Elevations range from about 500 feet at the mouth of the creek to 1,600 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned, although approximately half of the basin is owned and managed by the Bureau of Land Management (BLM) for camping and dispersed recreation. Vehicle access exists via the Wilder Ridge Road from Ettersburg toward Honeydew.

The habitat inventory of July 29 and 30, 1996, was conducted by Ray Bevitori and Dave Smith (PCFWWRA). The total length of the stream surveyed was 5,514 feet with an additional 472 feet of side channel. Upper North Fork of Honeydew Creek is an F2 channel type for the entire 5,514 feet of stream reach surveyed. F2 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and boulder-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/29/96 through 7/30/96
USGS Quad Map: Honeydew Latitude: 40º 12' 21" Longitude: 124º 7' 11"

Stream Reach: 1

Channel Type: F2	Canopy Density: 76%
Bankfull Width: 35 ft	Coniferous Component: 29%
Channel Length:5514 ft	Deciduous Component: 71%
Riffle/Flatwater Mean Width: 14 ft	Pools by Stream Length: 15%
Total Pool Mean Depth: 1.4 ft	Pools >= 3 ft Depth: 37%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 57
Water Temperature: 62-67°F	Dominant Shelter: Boulders
Air Temperature: 66-87°F	Occurrence of Large Organic Debris: 2%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 74%	
Dominant Bank Substrate: Cobble/Gravel	

Embeddedness Value: 1: 0% 2: 0% 3: 87% 4: 0% 5: 13%

Young-of-the-year (YOY) and juvenile (1+) salmonids were observed from the streambanks by the survey crew during the stream survey of July 29 and 30, 1996. No biological sampling was conducted.

East Fork Honeydew Creek

East Fork Honeydew Creek is tributary to Honeydew Creek, tributary to the Mattole River, located in Humboldt County, California. East Fork Honeydew Creek's legal description at the confluence with Honeydew Creek is T03S R01W S13. Its location is 40°12'21" North latitude and 124°07'11" West longitude. East Fork Honeydew Creek is a first order stream and has approximately 5.3 miles of blue line stream according to the USGS Honeydew 7.5 minute quadrangle. East Fork Honeydew Creek drains a watershed of approximately 5.3 square miles. Summer base flow is approximately 0.5 cubic feet per second (cfs) at the mouth, but over 20 cfs is not unusual during winter storms. Elevations range from about 500 feet at the mouth of the creek to 1,600 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily under the management of the Bureau of Land Management and is managed for diverse recreation. Vehicle access exists via Wilder Ridge Road from Ettersburg towards Honeydew.

The habitat inventory of August 12 to 15, 1996, was conducted by Dave Smith and Ray Bevitori (PCFFWRA). The total length of the stream surveyed was 15,231 feet with an additional 884 feet of side channel. East Fork Honeydew Creek is an F2 channel type for the entire 15,231 feet of stream reach surveyed. F2 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and boulder-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 8/12/96 through 8/15/96
USGS Quad Map: Honeydew   Latitude: 40º 12' 21"   Longitude: 124º 7' 11"

Stream Reach: 1	
Channel Type: F2	Canopy Density: 69%
Bankfull Width: 22.8 ft	Coniferous Component: 9%
Channel Length:15231 ft	Deciduous Component: 91%
Riffle/Flatwater Mean Width: 16 ft	Pools by Stream Length: 20%
Total Pool Mean Depth: 1.4 ft	Pools >= 3 ft Depth: 29%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 66
Water Temperature: 60-70°F	Dominant Shelter: Boulders
Air Temperature: 65-90°F	Occurrence of Large Organic Debris: 4%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 68%	
Dominant Bank Substrate: Bedrock	

Embeddedness Value: 1: 0% 2: 28% 3: 72% 4: 0% 5: 0%

No sites were electrofished in East Fork Honeydew Creek in 1996. Young-of-the-year and juvenile salmonids were observed from the streambanks by the survey crew.

West Fork Honeydew Creek

West Fork Honeydew Creek is tributary to Honeydew Creek, tributary to the Mattole River, located in Humboldt County, California. West Fork Honeydew Creek's legal description at the confluence with the Mattole River is T03S R01W S24. Its location is 40°11'46" N. latitude and 124°07'31" W. longitude. West Fork Honeydew Creek is a first order stream and has approximately 2.2 miles of blue line stream according to the USGS Shubrick Peak 7.5 minute quadrangle. West Fork Honeydew Creek drains a watershed of approximately 2.5 square miles. Summer base runoff is approximately 0.1 cubic feet per second (cfs) at the mouth, but over 15 cfs is not unusual during winter storms. Elevations range from about 800 feet at the mouth of the creek to 2,200 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely owned by the Bureau of Land Management (BLM) and is managed for recreation. Vehicle access exists via the Shelter Cove Road from Redway to Ettersburg/Honeydew Road.

The habitat inventory of July 31, 1996, was conducted by Dave Smith and Ray Bevitori (PCFWWRA). The total length of the stream surveyed was 3,897 feet with no additional feet of side channel. West Fork Honeydew Creek is a B2 channel type for the entire 3,897 feet of stream reach surveyed. B2 channels are moderately entrenched, moderate gradient, riffle dominated channels with stable banks and boulder-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/31/96 through 7/31/96
USGS Quad Map: Honeydew Latitude: 40º 11' 46" Longitude: 124º 7' 31"

Stream Reach: 1	
Channel Type: B2	Canopy Density: 75%
Bankfull Width: ft	Coniferous Component: 13%
Channel Length:3897 ft	Deciduous Component: 87%
Riffle/Flatwater Mean Width: 15 ft	Pools by Stream Length: 12%
Total Pool Mean Depth: 1.5 ft	Pools >= 3 ft Depth: 38%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 83
Water Temperature: 60-63°F	Dominant Shelter: Boulders
Air Temperature: 62-75°F	Occurrence of Large Organic Debris: 10%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 76%	
Dominant Bank Substrate: Bedrock	

Embeddedness Value: 1: 0% 2: 94% 3: 6% 4: 0% 5: 0%

No sites were electrofished during the 1996 survey of West Fork Honeydew Creek. Juvenile salmonids were observed from the stream bank by the survey crew throughout the survey.

Bear Creek

Bear Creek is tributary to the Mattole River, located in Humboldt County, California. Bear Creek's legal description at the confluence with the Mattole River is T04S R02E S06. Its location is 40°08'07" North latitude and 123°59'43" West longitude. Bear Creek is a third order stream and has approximately 21.9 miles of blue line stream according to the USGS Ettersburg, Shelter Cove, and Honeydew 7.5 minute quadrangles. Bear Creek drains a watershed of approximately 21.7 square miles. Summer base flow is approximately 8 cubic feet per second (cfs) at the mouth, but over 50 cfs is not unusual during winter storms. Elevations range from about 600 feet at the mouth of the creek to 2,200 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily owned by the Bureau of Land Management and is managed for dispersed recreation. Vehicle access exists via the Shelter Cove Road west from Redway to Honeydew Road.

The habitat inventory of September 3 - 6, 1996, was conducted by Greg Mullins and Frank Humphrey (PCFWWRA). The total length of the stream surveyed was 38,174 feet with an additional 1,931 feet of side channel. Bear Creek is an F3 channel type for the first 15,114 feet of stream reach surveyed, an F2 for the next 9,017 feet of stream, a B2 for the next 8,437 feet, and an F2 again for the final 5,606 feet of stream surveyed. F3 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and cobble-dominant substrates. F2 channels are similar to F3 types, but with boulder-dominant substrates. B2 channels are moderately entrenched, moderate gradient, riffle dominated channels with stable banks and boulder-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 9/3/96 through 9/4/96
USGS Quad Map: Ettersburg Latitude: 40º 8' 7" Longitude: 123º 59' 43"

Stream Reach: 1

Channel Type: F3	Canopy Density: 44%
Bankfull Width: 53.8 ft	Coniferous Component: 10%
Channel Length:15114 ft	Deciduous Component: 90%
Riffle/Flatwater Mean Width: 26 ft	Pools by Stream Length: 31%
Total Pool Mean Depth: 3.9 ft	Pools >= 3 ft Depth: 92%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 85
Water Temperature: 57-69ºF	Dominant Shelter: Boulders
Air Temperature: 49-79ºF	Occurrence of Large Organic Debris: 2%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft

Vegetative Cover: 41%
Dominant Bank Substrate: Bedrock
Embeddedness Value: 1: 43% 2: 41% 3: 16% 4: 0% 5: 0%

Stream Reach: 2

Channel Type: F2	Canopy Density: 44%
Bankfull Width: 27 ft	Coniferous Component: 10%
Channel Length:9017 ft	Deciduous Component: 90%
Riffle/Flatwater Mean Width: 31 ft	Pools by Stream Length: 27%
Total Pool Mean Depth: 3.3 ft	Pools >= 3 ft Depth: 76%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 90
Water Temperature: 55-61ºF	Dominant Shelter: Boulders
Air Temperature: 51-67ºF	Occurrence of Large Organic Debris: 2%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft

Vegetative Cover: 38%
Dominant Bank Substrate: Bedrock
Embeddedness Value: 1: 74% 2: 4% 3: 22% 4: 0% 5: 0%

Stream Reach: 3

Channel Type: B2	Canopy Density: 51%
Bankfull Width: 28.6 ft	Coniferous Component: 26%
Channel Length:8437 ft	Deciduous Component: 74%
Riffle/Flatwater Mean Width: 28 ft	Pools by Stream Length: 39%
Total Pool Mean Depth: 2.5 ft	Pools >= 3 ft Depth: 84%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 78
Water Temperature: 55-62ºF	Dominant Shelter: Boulders
Air Temperature: 53-74ºF	Occurrence of Large Organic Debris: 6%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft

Vegetative Cover: 15%
Dominant Bank Substrate: Bedrock
Embeddedness Value: 1: 45% 2: 29% 3: 26% 4: 0% 5: 0%

Stream Reach: 4

Channel Type: F2	Canopy Density: 42%
Bankfull Width: 46.6 ft	Coniferous Component: 33%
Channel Length:5606 ft	Deciduous Component: 67%
Riffle/Flatwater Mean Width: 27 ft	Pools by Stream Length: 28%
Total Pool Mean Depth: 2.3 ft	Pools >= 3 ft Depth: 80%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 78
Water Temperature: 59-62°F	Dominant Shelter: Boulders
Air Temperature: 73-78°F	Occurrence of Large Organic Debris: 3%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 18%	
Dominant Bank Substrate: Bedrock	
Embeddedness Value: 1: 40% 2: 7% 3: 53% 4: 0% 5: 0%	

One site was electrofished on September 4, 1996, in Bear Creek. The site was sampled by Todd Kraemer (WSP/AmeriCorps) and Ray Bevitori (PCFWWRA). The site sampled included habitat unit 025, a step run approximately 3,282 feet from the confluence with the Mattole River. This site had an area of 3,400 sq ft and a volume of 3,060 cu ft. The site yielded 20 young-of-the-year (YOY) steelhead rainbow trout, six 1+ steelhead rainbow trout, and three coho YOY.

Jewett Creek

Jewett Creek is tributary to Bear Creek, tributary to the Mattole River, located in Humboldt County, California. Jewett Creek's legal description at the confluence with the Mattole River is T04S R01E S12. Its location is 40°07'43" North latitude and 124°00'51" West longitude. Jewett Creek is a first order stream and has approximately 2.8 miles of ephemeral stream according to the USGS Honeydew 7.5 minute quadrangle. Jewett Creek drains a watershed of approximately 2.3 square miles. Summer base flow is approximately 1.0 cubic feet per second (cfs) at the mouth, but over 15 cfs is not unusual during winter storms. Elevations range from about 640 feet at the mouth of the creek to 1,200 feet in the headwater areas. Grassland and mixed hardwood dominate the watershed. The watershed is entirely privately owned and is managed for rangeland, timber production and rural residence. Vehicle access exists via Wilder Ridge Road to the community of Ettersburg.

The habitat inventory of July 16, 17, and 18, 1996, was conducted by Dave Smith and Ray Bevitori (PCFWWRA). The total length of the stream surveyed was 14,415 feet.

Jewett Creek is an F4 channel type for the entire 14,415 feet of stream reach surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/16/96 through 7/18/96
USGS Quad Map: Honeydew Latitude: 40º 7' 43" Longitude: 124º 0' 51"

Stream Reach: 1

Channel Type: F4	Canopy Density: 90%
Bankfull Width: 18 ft	Coniferous Component: 2%
Channel Length:14415 ft	Deciduous Component: 98%
Riffle/Flatwater Mean Width: 10 ft	Pools by Stream Length: 16%

Total Pool Mean Depth: 1 ft	Pools >= 3 ft Depth: 6%
Base Flow: 1.3 cfs	Mean Pool Shelter Rating: 47
Water Temperature: 55-62°F	Dominant Shelter: Boulders
Air Temperature: 55-75°F	Occurrence of Large Organic Debris: 19%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 30 ft
Vegetative Cover: 67%	
Dominant Bank Substrate: Silt/Clay/Sand	
Embeddedness Value: 1: 1% 2: 4% 3: 94% 4: 0% 5: 0%	

One site was electrofished on July 8, 1996, in Jewett Creek. The sites were sampled by Ruth Goodfield (CDFG) and Kelley Garrett (WSP/AmeriCorps). The site sampled included habitat units 002-003, a riffle/pool sequence approximately 99 feet from the confluence with Bear Creek. This site had an area of 576 sq ft and a volume of 461 cu ft. The site yielded seven young-of-the-year (YOY) steelhead rainbow trout.

North Fork Bear Creek

North Fork Bear Creek is tributary to Bear Creek, tributary to the Mattole River, located in Humboldt County, California. North Fork Bear Creek's legal description at the confluence with Bear Creek is T04S R01E S09. Its location is 40°07'35" North latitude and 123°03'41" West longitude. North Fork Bear Creek is a second order stream and has approximately 4.4 miles of blue line stream according to the USGS Ettersburg 7.5 minute quadrangle. North Fork Bear Creek drains a watershed of approximately 5.3 square miles. Summer base flow is approximately 4.5 cubic feet per second (cfs) at the mouth, but over 30 cfs is not unusual during winter storms. Elevations range from about 940 feet at the mouth of the creek to 2,300 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily owned by the Bureau of Land Management and is managed for recreation. Vehicle access exists via Wilder Ridge Road from Ettersburg.

The habitat inventory of July 8, 9, 10, and 11, 1996, was conducted by Dale Melton (WSP\AmeriCorps) and Frank Humphrey (PCFWWRA). The total length of the stream surveyed was 17,774 feet with an additional 553 feet of side channel. North Fork Bear Creek is a B4 channel type for the first 13,152 feet and an A3 channel type for the remaining 4,622 feet of stream reach surveyed. B4 channels are entrenched, meandering, riffle/pool channels on moderate gradients with high width/depth ratios and gravel-dominant substrates. A3 channels are steep, narrow streams with high energy/debris transport and cobble-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/3/96 through 7/10/96
USGS Quad Map: Ettersburg Latitude: 40º 7' 35" Longitude: 124º 3' 41"

Stream Reach: 1	
Channel Type: B4	Canopy Density: 50%
Bankfull Width: 31 ft	Coniferous Component: 9%
Channel Length:13152 ft	Deciduous Component: 91%
Riffle/Flatwater Mean Width: 20 ft	Pools by Stream Length: 11%
Total Pool Mean Depth: 1.7 ft	Pools >= 3 ft Depth: 60%
Base Flow: 5.9 cfs	Mean Pool Shelter Rating: 43

Water Temperature: 58-69°F	Dominant Shelter: Boulders
Air Temperature: 60-83°F	Occurrence of Large Organic Debris: 2%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 69%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 29% 2: 32% 3: 39% 4: 0% 5: 0%	
Stream Reach: 2	
Channel Type: A3	Canopy Density: 76%
Bankfull Width: ft	Coniferous Component: 10%
Channel Length:4622 ft	Deciduous Component: 90%
Riffle/Flatwater Mean Width: 15 ft	Pools by Stream Length: 22%
Total Pool Mean Depth: 1.7 ft	Pools >= 3 ft Depth: 64%
Base Flow: 5.9 cfs	Mean Pool Shelter Rating: 48
Water Temperature: 59-64°F	Dominant Shelter: Boulders
Air Temperature: 65-79°F	Occurrence of Large Organic Debris: 1%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 67%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 42% 2: 47% 3: 11% 4: 0% 5: 0%	

One site was electrofished on July 8, 1996, in North Fork Bear Creek. The sites were sampled by Ruth Goodfield (CDFG) and Kelley Garrett (WSP/AmeriCorps). The site sampled included habitat units 0165-0166, a riffle/run sequence approximately 10,820 feet from the confluence with Bear Creek. This site had an area of 750 sq ft and a volume of 750 cu ft. The site yielded five young-of-the-year (YOY) steelhead rainbow trout.

North Fork Bear Creek Tributary #1

Unnamed Tributary to North Fork Bear Creek is tributary to North Fork Bear Creek, tributary to Bear Creek, tributary to the Mattole River, located in Humboldt County, California. Unnamed Tributary to North Fork Bear Creek's legal description at the confluence with North Fork Bear Creek is T04S R01E S32. Its location is 40°09'03" North latitude and 124°05'34" West longitude. Unnamed Tributary to North Fork Bear Creek is a first order stream and has approximately 1.7 miles of blue line stream according to the USGS Honeydew 7.5 minute quadrangle. Unnamed Tributary to North Fork Bear Creek drains a watershed of approximately 1.2 square miles. Summer base flow is approximately 0.2 cubic feet per second (cfs) at the mouth, but over 10 cfs is not unusual during winter storms. Elevations range from about 1,000 feet at the mouth of the creek to 2,700 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is owned entirely by the Bureau of Land Management and is managed for diverse recreation. Vehicle access exists via Briceland Road west from the town of Redway and then north and east on Horse Mountain Road approximately 7.2 miles to the mouth of Unnamed Tributary to North Fork Bear Creek.

The habitat inventory of July 23, 24, and 25, 1996, was conducted by Rick Abbey and Mike Mezlin (PCFWWRA). The total length of the stream surveyed was 9,252 feet with an additional 677 feet of side channel. Unnamed Tributary to North Fork Bear Creek is a B2 channel type for the first 7,651 feet of stream reach surveyed, and an A2 channel type for the remaining 1,601 feet of stream surveyed. B2 channels are moderately entrenched, moderate gradient, riffle dominated channels with stable banks and boulder-dominant substrates. A2 channel types are steep, narrow, cascading, step-pool streams with high energy/debris transport associated with depositional soils, and boulder-dominated substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 7/23/96 through 7/23/96
USGS Quad Map: Honeydew Latitude: 40º 9' 3" Longitude: 124º 5' 34"

Stream Reach: 1

Channel Type: B5	Canopy Density: 57%
Bankfull Width: 20 ft	Coniferous Component: 47%
Channel Length:7651 ft	Deciduous Component: 53%
Riffle/Flatwater Mean Width: 13 ft	Pools by Stream Length: 26%
Total Pool Mean Depth: 0.9 ft	Pools >= 3 ft Depth: 13%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 34
Water Temperature: 59-64ºF	Dominant Shelter: Boulders
Air Temperature: 63-79ºF	Occurrence of Large Organic Debris: 3%
Dominant Bank Vegetation: Brush	Dry Channel: 0 ft
Vegetative Cover: 65%	
Dominant Bank Substrate: Silt/Clay/Sand	

Embeddedness Value: 1: 24% 2: 64% 3: 10% 4: 0% 5: 2%

Stream Reach: 2

Channel Type: A2	Canopy Density: 59%
Bankfull Width: 20 ft	Coniferous Component: 53%
Channel Length:1601 ft	Deciduous Component: 47%
Riffle/Flatwater Mean Width: 17 ft	Pools by Stream Length: 57%
Total Pool Mean Depth: 0.9 ft	Pools >= 3 ft Depth: 7%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 17
Water Temperature: 60-61ºF	Dominant Shelter: Boulders
Air Temperature: 64-74ºF	Occurrence of Large Organic Debris: 4%
Dominant Bank Vegetation: Brush	Dry Channel: 0 ft
Vegetative Cover: 63%	
Dominant Bank Substrate: Silt/Clay/Sand	

Embeddedness Value: 1: 20% 2: 60% 3: 13% 4: 0% 5: 7%

Young-of-the-year (YOY) salmonids were observed from the streambanks during the 1996 stream surveys. No biological sampling was conducted.

South Fork Bear Creek

South Fork Bear Creek is tributary to Bear Creek, tributary to the Mattole River, located in Humboldt County, California. South Fork Bear Creek's legal description at its confluence with North Fork Bear Creek is T04S R01E S09. The confluence location is 40°07'35" North latitude and 124°03'41" West longitude. South Fork Bear Creek is a second order stream and has approximately 13 miles of blue line stream according to the USGS Ettersburg, Honeydew, and Shelter Cove 7.5 minute quadrangles. South Fork Bear Creek drains a watershed of approximately 8.6 square miles. Summer base flow is approximately 1.5 cubic feet per second (cfs) at the mouth, but over 25 cfs is not unusual during winter storms.

Elevations range from about 940 feet at the mouth of the creek to 2,100 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily owned by the Bureau of Land Management and is managed for recreation. Vehicle access exists from the Shelter Cove Road via Horse Mountain Road in the Kings Range National Conservation Area.

The habitat inventory of June 24 through July 16, 1996, was conducted by Frank Humphrey and Greg Mullins (PCFWWRA). The total length of the stream surveyed was 63,155 feet with an additional 4,039 feet of side channel. South Fork Bear Creek is a B2 channel type for the first 9,780 feet of stream reach surveyed; an F3 channel type for the next 24,114 feet; a B3 channel type for 27,869 feet in the third reach; and reach 4 is an F3 for the remaining 1,392 feet of stream surveyed. B2 channels are moderately entrenched, moderate gradient, riffle-dominated channels with stable banks and boulder substrate. B3 channels are very similar, but the dominant substrate is cobble. F3 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and cobble-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 6/24/96 through 6/27/96
USGS Quad Map: Honeydew   Latitude: 40º 7' 35"   Longitude: 124º 3' 41"

Stream Reach: 1
Channel Type: B2
Bankfull Width: 36.6 ft
Channel Length:9780 ft
Riffle/Flatwater Mean Width: 23 ft
Total Pool Mean Depth: 2.1 ft
Base Flow: 1.5 cfs
Water Temperature: 53-61°F
Air Temperature: 55-67°F
Dominant Bank Vegetation: Deciduous Trees
Vegetative Cover: 50%
Dominant Bank Substrate: Cobble/Gravel
Embeddedness Value: 1: 33% 2: 57% 3: 10% 4: 0% 5: 0%

Canopy Density: 62%
Coniferous Component: 13%
Deciduous Component: 87%
Pools by Stream Length: 38%
Pools >= 3 ft Depth: 47%
Mean Pool Shelter Rating: 48
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 4%
Dry Channel: 0 ft

Stream Reach: 2
Channel Type: F3
Bankfull Width: 16.7 ft
Channel Length:24114 ft
Riffle/Flatwater Mean Width: 18 ft
Total Pool Mean Depth: 2.1 ft
Base Flow: 1.5 cfs
Water Temperature: 53-65°F
Air Temperature: 54-74°F
Dominant Bank Vegetation: Deciduous Trees
Vegetative Cover: 65%
Dominant Bank Substrate: Cobble/Gravel
Embeddedness Value: 1: 36% 2: 34% 3: 30% 4: 0% 5: 0%

Canopy Density: 85%
Coniferous Component: 29%
Deciduous Component: 71%
Pools by Stream Length: 27%
Pools >= 3 ft Depth: 28%
Mean Pool Shelter Rating: 32
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 6%
Dry Channel: 0 ft

Stream Reach: 3

Channel Type: B3	Canopy Density: 93%
Bankfull Width: 35 ft	Coniferous Component: 18%
Channel Length:27869 ft	Deciduous Component: 82%
Riffle/Flatwater Mean Width: 10 ft	Pools by Stream Length: 29%
Total Pool Mean Depth: 1.2 ft	Pools >= 3 ft Depth: 9%
Base Flow: 1.5 cfs	Mean Pool Shelter Rating: 45
Water Temperature: 52-67°F	Dominant Shelter: Terrestrial Vegetation
Air Temperature: 53-75°F	Occurrence of Large Organic Debris: 6%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 89%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 7% 2: 11% 3: 82% 4: 0% 5: 0%	

Stream Reach: 4

Channel Type: F4	Canopy Density: 96%
Bankfull Width: 12.3 ft	Coniferous Component: 87%
Channel Length:1392 ft	Deciduous Component: 13%
Riffle/Flatwater Mean Width: 6 ft	Pools by Stream Length: 9%
Total Pool Mean Depth: 0.8 ft	Pools >= 3 ft Depth: 0%
Base Flow: 1.5 cfs	Mean Pool Shelter Rating: 30
Water Temperature: 52-53°F	Dominant Shelter: Small Woody Debris
Air Temperature: 53-59°F	Occurrence of Large Organic Debris: 8%
Dominant Bank Vegetation: Deciduous Trees	Dry Channel: 400
Vegetative Cover: 84%	
Dominant Bank Substrate: Cobble/Gravel	
Embeddedness Value: 1: 0% 2: 0% 3: 100% 4: 0% 5: 0%	

Two sites were electrofished on July 2, 1996, in South Fork Bear Creek. The sites were sampled by Ruth Goodfield (CDFG), Kelley Garrett, and Todd Kraemer (WSP/AmeriCorps). The first site sampled included habitat units 0093-0094, a riffle/pool sequence, approximately 4,259 feet from the confluence with Bear Creek. This site had an area of 1,000 sq ft and a volume of 600 cu ft. The site yielded seven young-of-the-year (YOY) steelhead rainbow trout. The second site included habitat units 0174-0175, a run/pool sequence located approximately 7,857 feet above the creek mouth. This site had an area of 560 sq ft and a volume of 504 cu ft. The site yielded three YOY steelhead rainbow trout.

Big Finley Creek

Big Finley Creek is tributary to the Mattole River, located in Humboldt County, California. Big Finley Creek's legal description at the confluence with the Mattole River is T04S R02E S30. Its location is 40°05'14" north latitude and 123°59'56" west longitude. Big Finley Creek is a second order stream and has approximately 5.8 miles of blue line stream according to the USGS Briceland and Shelter Cove 7.5 minute quadrangles. Big Finley Creek drains a watershed of approximately 3.5 square miles. Elevations range from about 670 feet at the mouth of the creek to 1,900 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for dispersed recreation and rural residence. Vehicle access exists via the Briceland/Shelter Cove Road. Travel west from Redway to the Whitethorn Junction. Continue approximately 0.2 miles to an unpaved road that follows the north bank of the Mattole River. Continue on this road for about 3.5 miles to the mouth of Big Finley Creek.

The habitat inventory of September 29, 1998, was conducted by Carolyn Jezierzki and Stewart McMorrow (WSP). The total length of the stream surveyed was 8,497 feet with no additional feet of side channel. Big Finley Creek is a B4 channel type for the first 6,772 feet of stream reach surveyed, and an A2 channel type for the remaining 1,725 feet. B4 channels are moderately entrenched, meandering, riffle/pool channels on gradients of 2-4% with moderate width/depth ratios and gravel-dominant substrates. A2 channel types are steep, narrow, cascading step-pool streams with high energy/debris transport associated with depositional soils.

Survey Data:

Location of Stream Mouth:
Survey Dates: 9/29/1998 through 9/29/1998
USGS Quad Map: Briceland Latitude: 40º 5' 14" Longitude: 123º 59' 56"

Stream Reach: 1

Channel Type: B4	Canopy Density: 86%
Bankfull Width: 23 ft	Coniferous Component: 1%
Channel Length:6772 ft	Deciduous Component: 99%
Riffle/Flatwater Mean Width: 24 ft	Pools by Stream Length: 19%
Total Pool Mean Depth: 1.3 ft	Pools >= 3 ft Depth: 21%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 33
Water Temperature: 56-57ºF	Dominant Shelter: Boulders
Air Temperature: 57-65ºF	Occurrence of Large Organic Debris: 6%
Dominant Bank Cover: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 89%	
Dominant Bank Substrate: Bedrock	

Embeddedness Value: 1: 0% 2: 53% 3: 29% 4: 0% 5: 18%

Stream Reach: 2

Channel Type: A2	Canopy Density: 83%
Bankfull Width: 22 ft	Coniferous Component: 40%
Channel Length:1725 ft	Deciduous Component: 61%
Riffle/Flatwater Mean Width: 9 ft	Pools by Stream Length: 11%
Total Pool Mean Depth: 1.3 ft	Pools >= 3 ft Depth: 0%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 20
Water Temperature: 56-57ºF	Dominant Shelter: Boulders
Air Temperature: 60-65ºF	Occurrence of Large Organic Debris: 0%
Dominant Bank Cover:: Deciduous Trees	Dry Channel: 0 ft
Vegetative Cover: 94%	
Dominant Bank Substrate:Bedrock	

Embeddedness Value: 1: 0% 2: 71% 3: 14% 4: 0% 5: 14%

No sites were electrofished on September 9, 1998, in Big Finley Creek. Juvenile salmonids were observed by the surveyors throughout the length of stream surveyed.

South Fork of Big Finley Creek

South Fork Big Finley Creek is tributary to Big Finley Creek, tributary to the Mattole River, located in Humboldt County, California. South Fork Big Finley Creek's legal description at the confluence with Big Finley Creek is T04S R01E S25. Its location is 40°15'19" north latitude and 124°00'46" west longitude. South Fork Big Finley Creek is a second order stream and has approximately 2.8 miles of blue line stream according to the USGS Briceland and Shelter Cove 7.5 minute quadrangles. South Fork Big Finley Creek drains a watershed of approximately 1.3 square miles. Elevations range from about 900 feet at the mouth of the creek to 1,800 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned and is managed for rural residence and dispersed recreation. Vehicle access exists via the Briceland/Shelter Cove Road, west from Redway to the Whitethorn Junction. Continue approximately 0.2 miles to an unpaved road that follows the north bank of the Mattole River. Continue on this road for about 3.5 miles to the mouth of Big Finley Creek. Walk upstream approximately 4,600 feet to the mouth of South Fork Big Finley Creek.

The habitat inventory of October 1, 1998, was conducted by Caroline Jezierski and Stewart McMorrow (WSP). The total length of the stream surveyed was 6,654 feet with an additional 154 feet of side channel. South Fork Big Finley Creek is a B3 channel type for the entire 6,654 feet of stream reach surveyed. B3 channels are moderately entrenched, meandering, riffle/pool channels on 2-4% gradients with moderate width/depth ratios and cobble-dominant substrates.

Survey Data:

Location of Stream Mouth:
Survey Dates: 10/1/1998 through 10/1/1998
USGS Quad Map: Briceland   Latitude: 40º 5' 19"   Longitude: 124º 0' 46"

Stream Reach: 1	
Channel Type: B3	Canopy Density: 61%
Bankfull Width: 14 ft	Coniferous Component: 9%
Channel Length:6654 ft	Deciduous Component: 91%
Riffle/Flatwater Mean Width: 7 ft	Pools by Stream Length: 9%
Total Pool Mean Depth: 0.8 ft	Pools >= 3 ft Depth: 9%
Base Flow: 0 cfs	Mean Pool Shelter Rating: 26
Water Temperature: 56-56°F	Dominant Shelter: Boulders
Air Temperature: 56-60°F	Occurrence of Large Organic Debris: 4%
Dominant Bank Cover: Deciduous Trees	Dry Channel: 202
Vegetative Cover: 93%	
Dominant Bank Substrate Bedrock	

Embeddedness Value: 1: 0% 2: 40% 3: 49% 4: 0% 5: 11%

No sites were electrofished during the October 1, 1998 survey of South Fork Big Finley Creek.

Nooning Creek

Nooning Creek is tributary to the Mattole River, located in Humboldt County, California. Nooning Creek's legal description at the confluence with the Mattole River is T04S R02E S31. Its location is 40°03'52" North latitude and 123°59'38" West longitude. Nooning Creek is a second order stream and has approximately 2.2 miles of blue line stream according to the

USGS Briceland and Shelter Cove 7.5 minute quadrangles. Nooning Creek drains a watershed of approximately 1.4 square miles. Summer base flow is approximately 1.5 cubic feet per second (cfs) at the mouth, but over 25 cfs is not unusual during winter storms. Elevations range from about 860 feet at the mouth of the creek to 1,600 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily owned by the Bureau of Land Management and is managed for diverse recreation. The watershed also includes several private rural residences. Vehicle access exists by traveling west on Briceland Road approximately one mile past Thorn Junction to Nooning Creek Road.

The habitat inventory of June 18, 19, and 20, 1996, was conducted by Dave Smith and Dylan Brown (PCFWWRA). The total length of the stream surveyed was 7,948 feet with an additional 209 feet of side channel. Nooning Creek is an F3 channel type for the first 301 feet and a B2 for the remaining 7,647 feet of stream reach surveyed. F3 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and cobble-dominant substrates. B2 channels are moderately entrenched, moderate gradient, riffle-dominated channels with high width/depth ratios and boulder-dominant substrates.

__Survey Data:__

Location of Stream Mouth:
Survey Dates: 6/18/96 through 6/20/96
USGS Quad Map: Briceland Latitude: 40º 3' 52" Longitude: 123º 59' 38"

Stream Reach: 1
Channel Type: F3
Bankfull Width: 18 ft
Channel Length:301 ft
Riffle/Flatwater Mean Width: 13 ft
Total Pool Mean Depth: 1.3 ft
Base Flow: 2.1 cfs
Water Temperature: 52-53°F
Air Temperature: 56-65°F
Dominant Bank Vegetation: Deciduous Trees
Vegetative Cover: 89%
Dominant Bank Substrate: Bedrock
Embeddedness Value: 1: 0% 2: 0% 3: 100% 4: 0% 5: 0%

Canopy Density: 93%
Coniferous Component: 9%
Deciduous Component: 91%
Pools by Stream Length: 33%
Pools >= 3 ft Depth: 20%
Mean Pool Shelter Rating: 70
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 1%
Dry Channel: 0 ft

Stream Reach: 2
Channel Type: B2
Bankfull Width: 15 ft
Channel Length:7647 ft
Riffle/Flatwater Mean Width: 14 ft
Total Pool Mean Depth: 1 ft
Base Flow: 2.1 cfs
Water Temperature: 48-53°F
Air Temperature: 48-60°F
Dominant Bank Vegetation: Deciduous Trees
Vegetative Cover: 87%
Dominant Bank Substrate: Bedrock
Embeddedness Value: 1: 6% 2: 19% 3: 69% 4: 6% 5: 0%

Canopy Density: 83%
Coniferous Component: 18%
Deciduous Component: 82%
Pools by Stream Length: 17%
Pools >= 3 ft Depth: 8%
Mean Pool Shelter Rating: 62
Dominant Shelter: Boulders
Occurrence of Large Organic Debris: 4%
Dry Channel: 0 ft

Two sites were electrofished on July 1, 1996, in Nooning Creek. The sites were sampled by Kelley Garrett (WSP/AmeriCorps) and Ruth Goodfield (CDFG). The first site sampled included habitat units 0024-0025, a riffle/run sequence approximately 903 feet from the confluence with the Mattole River. This site had an area of 1,200 sq ft and a volume of 920 cu ft. The site yielded seven young-of-the-year (YOY) and three 1+ steelhead rainbow trout. The second site included habitat units 0035-0036, a run/pool sequence located approximately 1,252 feet above the creek mouth. This site had an area of 720 sq ft and a volume of 576 cu ft. The site yielded eight YOY steelhead rainbow trout.

List of Inventoried Streams

The table below includes priority ranking of habitat categories that provide improvement opportunities for each stream surveyed by CDFG in the Mattole Basin based upon the habitat survey and observations. The most urgent concern is assigned a '1', the next highest a '2', etc. "DP" indicates the data are now in the analysis and report process.

Table 44 recommendations are created from the results of standard CDFG habitat inventories. These inventories are a combination of several stream reach surveys: habitat typing, channel typing, biological assessments, and in some reaches LWD and riparian zone recruitment assessments. An experienced biologist and / or habitat specialist conducts QA/QC on field crews and collected data, performs data analysis, and determines general areas of habitat deficiency based upon the analysis and synthesis of information. Finally, recommendation categories for potential habitat improvement activities are selected and ranked.

It is important to understand that these selections are made from stream reach conditions that are observed at the times of the surveys and do not include upslope watershed observations other than those that can be seen from the streambed. They also reflect a single point in time and do not anticipate future conditions. However, these general recommendation categories have proven to be useful as the basis for specific project development, and provide focus for on-the-ground project design and implementation. Bear in mind that stream and watershed conditions change over time and periodic survey updates and field verification are necessary if projects are being considered.

In general, the recommendations that involve erosion and sediment reduction by treating roads and failing stream banks, and riparian and near stream vegetation improvements precede the instream recommendations in reaches that demonstrate disturbance levels associated with watersheds in current stress. Instream improvement recommendations are usually a high priority in streams that reflect watersheds in recovery or good health. Projects recommendation can be made in concurrence if conditions warrant.

Fish passage problems, especially in situations where favorable stream habitat reaches are being separated by a man-caused feature (e.g., culvert), are usually a treatment priority. Good examples of these are the recent and dramatically successful Humboldt County / CDFG culvert replacement projects in tributaries to Humboldt Bay. In these regards, NCWAP's more general watershed scale upslope assessments can go a long way in helping determine the suitability of conducting instream improvements based upon watershed health. As such, there is an important relationship between the instream and upslope assessments.

Additional considerations enter into the decision process before these general recommendations are further developed into improvement activities. In addition to watershed condition considerations as a context for these recommendations, there are certain logistic considerations that enter into a recommendation’s subsequent ranking for project development. These can include work party access limitations based upon lack of private party trespass permission and / or physically difficult or impossible locations of the candidate work sites. Biological considerations are made based upon the propensity for benefit to multiple or single fishery stocks or species. Cost benefit and project feasibility are also factors in project selection for design and development.

Key to fields: Temp = summer water temperatures seem to be above optimum for salmon and steelhead; Pool = pools are below target values in quantity and/or quality; Cover = escape cover is below target values; Bank = stream banks are failing and yielding fine sediment into the stream; Roads = fine sediment is entering the stream from the road system; Canopy = shade canopy is below target values; Spawning Gravel = spawning gravel is deficient in quality and/or quantity; LDA = large debris accumulations are retaining large amounts of gravel and could need modification; Livestock = there is evidence that stock is impacting the stream or riparian area and exclusion should be considered; Fish Passage = there are barriers to fish migration in the stream.

Table 44. Recommendations Summary for the Mattole River Tributaries.

Stream	Surveyed Length	Bank	Roads	Canopy	Temp	Pool	Cover	Spawning Gravel	LDA	Livestock	Fish Passage
Main Stem Mattole River (50)											
Northern Subbasin											
North Fork Mattole River	15,767	1	2	3	4	6	5				
Sulphur Creek	7137	1	2	5		3	4				
Sulphur Creek Tributary #1	598	2	3	6		1	5	4			
Sulphur Creek Tributary #2	2632	3	4	5		1	2				
Conklin Creek	3163	4	5	2	1	6	7			3*	
McGinnis Creek	19,500	1	2	3	4	5	6				
Oil Creek	16,530	2		1	4	3	5		6		
Green Ridge Creek	3710	4		2		1	3				
Devils Creek	7334	4		2		1	3				
Rattlesnake Creek	22,234	5		1	2	3	4				
Eastern Subbasin											
Dry Creek	8548	4	6	2	1	3	5				
Middle Creek	7475	1	2	3	6	5	4				

Stream	Surveyed Length	Bank	Roads	Canopy	Temp	Pool	Cover	Spawning Gravel	LDA	Livestock	Fish Passage
Westlund Creek	16,979	1	2		5	3	4		6		
Gilham Creek	9992	1	2	7		5	3	4	6		8
Gilham Creek Tributary #1	3051	1	2	6		4	3	5			
Fourmile Creek	15,566	4	5	3	2	1	6		7		
North Fork Fourmile Creek	6187	3	4	2	1	5	6	7			
Sholes Creek	21,247	2	3	6	7	4	1		5		
Harrow Creek	1222	3	4	7		6	5	1	2		
Little Grindstone Creek	2991	3	4	6		1	2		5		
Grindstone Creek	13,772	3	6	2	1	4	5		7		
Blue Slide Creek	33,416	4	3	1	2	5	6				
Fire Creek	10,723	4	3	5	1	2	6		7		
Box Canyon Creek	2776		5	1		2	3				4
Eubank Creek	17,556	3			5	4	2		1		
McKee Creek	11,779	3	4			1	2				
Tributary to McKee Creek	397	2		3		1					
Painter Creek	1616			3		1	2				
Southern Subbasin											
Bridge Creek	16,467	3	4			1	2				
West Fork Bridge Creek	7386	3	4			1	2		5		
South Branch West Fork Bridge Creek	7456	4	5	6	7	2	3		1		
Vanauken Creek	7456	2	4			1			3		5
South Fork Vanauken Creek	449	1	2				3				
Anderson Creek	5012	3				1	2				
Mill Creek (R.M. 56.2)	934	3	4			2	1				

Stream	Surveyed Length	Bank	Roads	Canopy	Temp	Pool	Cover	Spawning Gravel	LDA	Livestock	Fish Passage
Upper Mattole River	35,199	1	2			3					
Stanley Creek	5076	2	3			4	1		6		5
Baker Creek	11,852	5	4			1	2	3			
Thompson Creek	17,337	3	4				2		1		
Yew Creek	3444	2	3				1				
Helen Barnum Creek	5012		3			1	2				
Lost Man Creek	6112		4			2			3		1
Lost Man Creek Tributary #1	6558		4			2	1		3		
Western Subbasin											
Mill Creek (R.M. 2.8)	5805	4	3			2	1				
Mill Creek Tributary #1	808			2			1				
Mill Creek Tributary #2	175			1			2				
Squaw Creek	21,506	3	4	2	1		5				
Woods Creek	9893	3	4	5		1	2		6		7
Honeydew Creek	23,178	3		5	4	1	2				
Bear Trap Creek	9883	1	2	6	5	3	4				
Upper North Fork Honeydew Creek	5514	3		5	4	1	2				6
East Fork Honeydew Creek	15,231	2	5	4	3	1	6				
West Fork Honeydew Creek	3897	4		5		2	3				1
Bear Creek	38,174	2		1		3	4				
Jewett Creek	14,415	1				4	5		3	2	
North Fork Bear Creek	17,774	5		2	1	6	3		4		

Stream	Surveyed Length	Bank	Roads	Canopy	Temp	Pool	Cover	Spawning Gravel	LDA	Livestock	Fish Passage
North Fork Bear Creek Tributary #1	9252	5		2		4	3				1
South Fork Bear Creek	63,155	2				4	1		3		
Big Finley Creek	8497	3				1	2				
South Fork of Big Finley Creek	6654					2	1				
Nooning Creek	7948	1			5	3	2		4		

*DP = Data Pending

CDFG Macroinvertebrate Data Analysis Report

Introduction

Macroinvertebrates assemblages in a stream can serve as an indicator of biological integrity and the ability of a stream to support designated uses such as strong fish populations. Macroinvertebrates are sensitive to streambed sediment alterations, can integrate the effects of changes over time and tend to characterize local conditions. In the Mattole Basin, the Bureau of Land Management (BLM) has monitored macroinvertebrates in various streams as a part of a larger monitoring effort since 1996 and their findings are summarized five reports (Aquatic Invertebrate Monitoring Report for the Arcata Resource Area 1997, 1998, 1999, 2000, 2001). In addition, the Pacific Lumber Company (PALCO) has collected macroinvertebrates in several streams on their land since 1994 (PALCO 2000, Oliver personal communication).

Data and Methods

BLM Data

The BLM collected samples in 12 streams at 14 sampling points in the Mattole Basin, collecting 3-9 samples on each sampling event (Table 45). Six samples are in the Southern Subbasin, 7 are in the Western Subbasin and 1 is in the Northern Subbasin (Map 1). Samples were taken both qualitatively and quantitatively using kick nets and Surber samplers.

Samples were taken in either the spring and early summer or the fall. Streams were categorized as reference (best conditions available) or non-reference. There were more non-reference sites sampled than reference sites, however there were more samples taken from non-reference sites (Figure 23).

All samples were sent to the BLM National Aquatic Monitoring Center in Logan Utah for processing and analysis. The BLM calculated a number of indices for each sample based on the amount and types of macroinvertebrates found (Table 46). Shannon and Simpson's diversity indices indicate the diversity at a site. Diversity tends to decrease with impairment but may increase with organic enrichment. Evenness indicates the distribution of individuals among taxa. Dominance of a single taxon can indicate impairment. The Modified Hilsenhoff

Table 45. The number of macroinvertebrate samples taken by the BLM in the Mattole Basin in the past five years.

QL indicates a qualitative sample and QN indicates a quantitative or fixed area sample. R indicates that a site is considered to be reference condition by the BLM and NR indicates that a site is not considered to be reference condition.

Creek	Subbasin	1996	1997	1998	1999	2000
Conklin Creek - NR	Northern	3 – QL**				
Bridge Creek -NR	Southern		6 – QL***		6 – QN***	
Mattole River at Stanley Creek - NR	Southern				6 –QN***	
Baker Creek - NR	Southern				3 – QN*	
Thompson Creek - R	Southern				6 – QN***	
Yew Creek - R	Southern			5 – QN**	6 – QN***	
Mattole River at Pip e Creek - R	Southern				6 –QN***	
Mill Creek (R.M. 2.8) - NR	Western	3 – QL**				
West Fork of Mill Creek (R.M 2.8)- R	Western		6 – QL***	9 – QN***	8 – QN***	4 –QN*
Honeydew Creek - NR	Western		3 – QL**	3 – QN*		
North Fork of Bear Creek - NR	Western		3 –QL**	3 – QN*		
South Fork of Bear Creek at Confluence - NR	Western		3 – QL**	3 – QN*		
South Fork of Bear Creek at Shelter Cove Road - NR	Western		6 – QL***	7 – QN***	8 – QN***	8 – QN***
South Fork of Bear Creek at Wailaki - R	Western		6 – QL***	7 – QN***	8 – QN***	8 – QN***

* Sampled in the spring.
** Sampled in the fall.
*** Sampled in both the spring and the fall.

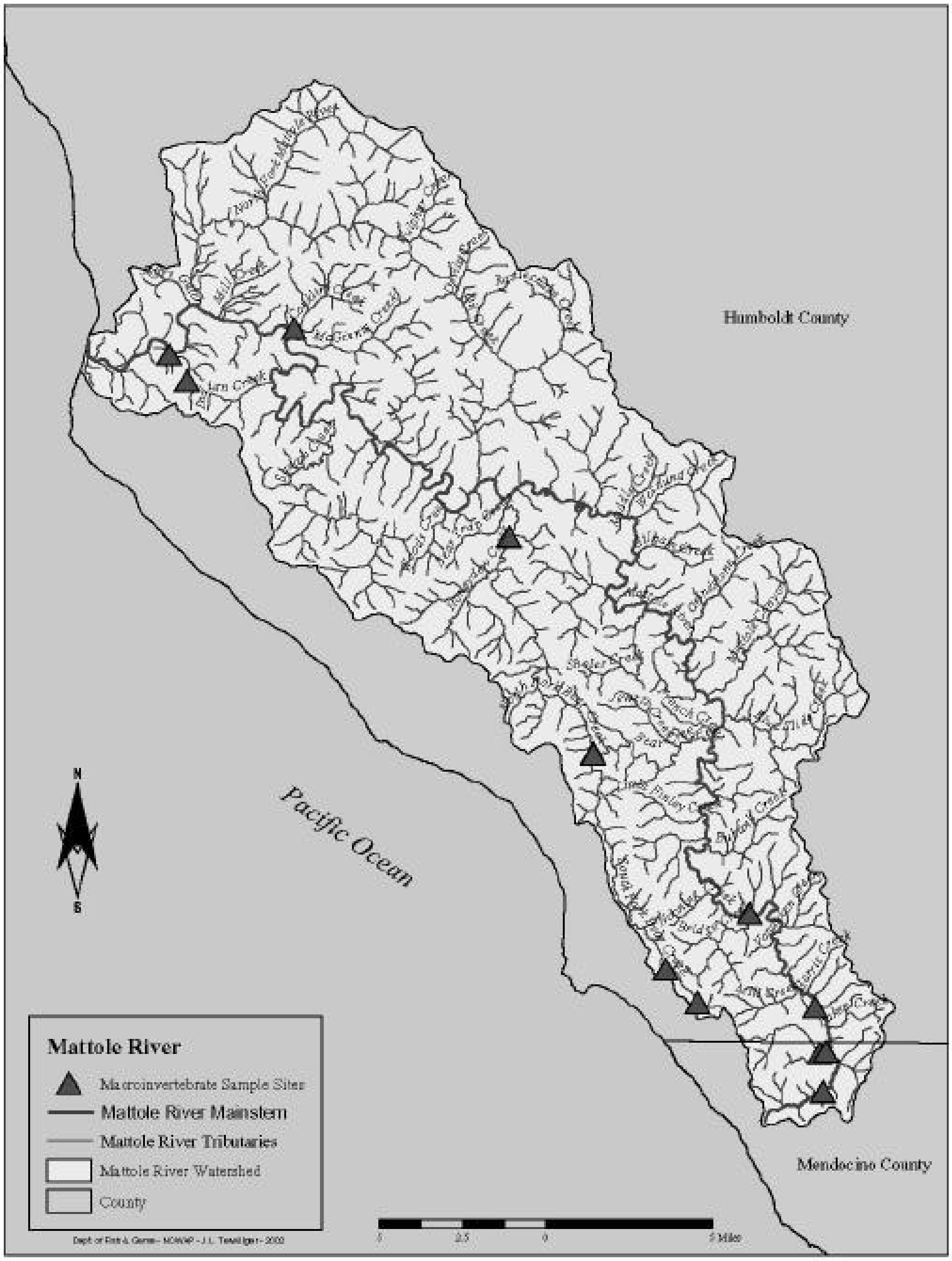


Figure 21. BLM macroinvertebrate sampling in the Mattole Basin from 1996-2000.

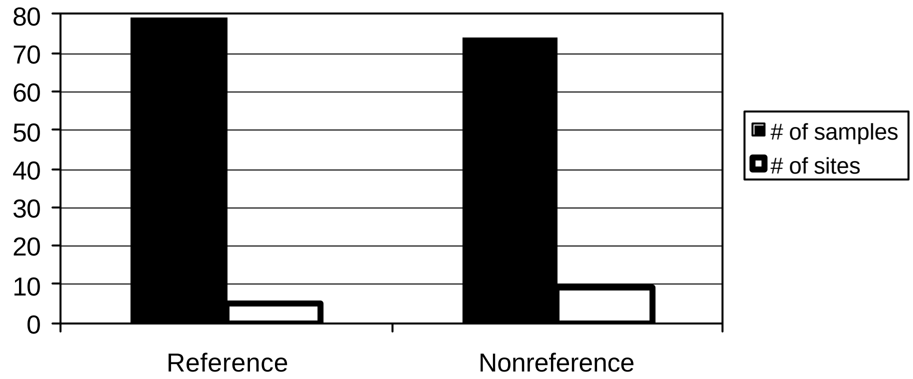


Figure 22. The number of BLM reference and non reference samples and sites they were taken from.

Biotic Index and the United States Forest Service (USFS) Biotic Condition Index look at the tolerances to pollution of taxa found at a site and are indicative of organic enrichment and overall condition of a site, respectively. The Biotic Condition Index was only calculated for samples taken in 1999. Lastly, Karr and Chu's index is a composite of ten metrics. The metrics are measures of richness, tolerance, feeding, habit and life cycle that were found to respond to human-induced disturbance by Karr and Chu (1998) (Table 47). Individual metric values were compared to metric scores for regional reference sites and given a score of five if the metric was equal to or greater than the 95th percentile of the mean of all reference values, three if the metric was between the 75th and 95th percentile of all reference values, and a one if the metric was less than the 75th percentile of the mean of the reference values. These individual metric scores were then summed for each sample to obtain a total metric score. Total metric scores with a percent comparison to reference greater than 80% are considered non-impaired, 50-80% slightly impaired, 25-50% moderately impaired and <25% severely impaired.

Table 46. Indices calculated by the BLM National Aquatic Monitoring Center.

Index	Description	Expected Response to Impaired Stream Conditions
Shannon Diversity Index	Index of diversity based on taxa richness and relative abundance. $$H = \sum_{i=1}^{s} (p_i \ln p_i)$$ where S is the total number of taxa and p_i is the proportional abundance of the i^{th} species. Increases with increasing diversity.	Low diversity can be an indicator of impairment.
Simpson Diversity Index	Index of diversity based on taxa richness and relative abundance. $$D = 1 - \sum_{i-1}^{s} (p_i)^2$$ where S is the total number of taxa and p_i is the proportion of individuals of taxa *i* in the assemblage. Ranges from 0 (low diversity) to 1 –1/S where S is the number of taxa (high diversity).	Low diversity can be an indicator of impairment.
Evenness	Measures the distribution of taxa within a community. Ranges from 0 (a single taxa is more dominant) to 1 (abundances are distributed more evenly among species).	Dominance of a single taxa can be an indicator of impairment.
Modified Hilsenhoff Biotic Index	Summarizes the overall pollution tolerances of taxa collected. Has been used to detect organic pollution, nutrient enrichment, high sediment loads, low dissolved oxygen, and thermal impacts.	Values of 0-2 indicate clean conditions, 2-4 slightly enriched conditions, 4-7 enriched conditions, and 7-10 polluted conditions.
USFS Biotic Condition Index*	Compares predicted and actual pollution tolerances for macroinvertebrates in a sample when data on alkalinity, sulfate, substrate size and stream gradient are available.	Values >90 indicate excellent condition, 80-90 indicate good condition, 72-79 fair condition and <72 poor condition.
Karr and Chu Index	Composite measure of 10 metrics of richness, tolerance, feeding, habit and life cycle found to respond to human-induced disturbance by Karr and Chu (1998). Metrics summarized in Table 3.	Values >40 (80 % of reference) indicate no impairment, 25-40 (50-80% of reference) indicate slight impairment, 12.5-25 (25-50% of reference) and <12.5 (<25% of reference) indicate severe impairment.

* only calculated for 1999

Table 47. The ten metrics thought to be most responsive to human-induced disturbance by Karr and Chu (1998).

Category	Metric	Definition
Richness Measures	Total Taxa	Total number of distinct taxa found in a sample
	Ephemeroptera Taxa	Total number of Ephemeroptera taxa found in a sample
	Plecoptera Taxa	Total number of Plecoptera taxa found in a sample
	Trichoptera Taxa	Total number of Trichoptera taxa found in a sample
Tolerance/Intolerance Measures	Intolerant Taxa	Total number of intolerant taxa found in a sample
	% Tolerants	% Tolerant taxa found in a sample
	% Dominant Taxon	% Individuals in a sample belonging to the dominant taxon
Habit Measures	Clinger Taxa	Total number of clinger taxa (cling to the tops of rocks) found in a sample
Feeding Measures	% Predators	% Predators found in a sample
Life Cycle Measures	Long Lived Taxa	Total number of long-lived taxa (2-3 year life cycles) found in a sample

PALCO Data

PALCO collected samples in eight streams at eleven sampling points in the Mattole Basin, collecting 3 samples on each sampling event (Table 48). Samples taken on Baker Creek, Oil Creek, Green Ridge Creek, and Rattlesnake Creek in 1994 were taken in conjunction with CDFG. All sampled streams are in the Northern Subbasin, except for Baker Creek, which is in the Southern Subbasin (Map 1). Samples were taken using kick nets following standard California Stream Bioassessment Procedures (CDFG 1993). Three samples were taken at each sampling site and combined. All samples were taken in the fall.

Table 48. Macroinvertebrate samples taken by PALCO in the Mattole Basin in the past seven years.

Creek	Subbasin	1994	1995	1996	1997	1998	1999	2000	2001
Alwardt Creek	Northern	X	X	X	X	X	X	X	
Rodgers Creek	Northern	X	X	X	X	X	X	X	
Sulphur Creek	Northern					X	X	X	X
Upper North Fork Mattole River	Northern					X	X	X	X
Oil Creek	Northern	X							
Green Ridge Creek	Northern	X							
Rattlesnake Creek	Northern	X							
Baker Creek	Southern	X							

Samples were sent to John Lee Consulting in Arcata, California for processing and analysis. PALCO calculated a number of indices for each sample based on the amount and types of macroinvertebrates found. Similarly to the BLM, Simpson's Diversity Index and the Modified Hilsenhoff Biotic Index were calculated; however, both indices were calculated in a different manner. Simpson's Diversity Index was calculated as

$$D = \frac{1}{\sum_{i=1}^{s} (p_i)^2}$$

where S is the total number of species in the community and p_i is the proportion of individuals of taxa *i* in the assemblage. Simpson's Diversity Index tends to decrease with impairment but may increase with organic enrichment. For analyses purposes, PALCO used values from 0.70 to 0.79 to indicate poor conditions, 0.80 to 0.89 average conditions, and 0.90 to 1.00 good conditions. In addition, PALCO used an unmodified Hilsenhoff Biotic Index before 1997. The modification used after this date raised the values of the index. Although PALCO did not calculate the Karr and Chu Index, a similar index developed by CDFG, the Russian River Index of Biological Integrity (RRIBI), was used. The RRIBI is a composite of six metrics. The metrics are measures of richness, composition, and tolerance that were found to respond to human-induced disturbance by CDFG (1999) (Table 49). Individual metric values were integrated into a single scoring criterion by producing histograms of the values for each of the biological metrics and visually determining breaks in their distribution. Metrics are given a score of one, three, or five (Table 50). These individual metric scores were then summed for each sample to obtain a total metric score. Total metric scores from 24-30 are considered representative of excellent biotic conditions, 18-23 good conditions, 12-17 fair conditions, and 6-11 poor conditions.

Table 49. The six metrics used in the Russian River Index of Biological Integrity (CDFG 1999).

Category	Metric	Definition
Richness Measures	Total Taxa	Total number of distinct taxa found in a sample
	Ephemeroptera, Plecoptera, and Trichoptera Taxa	Total number of Ephemeroptera, Plecoptera, and Trichoptera taxa found in a sample
Composition Measures	Ephemeroptera, Plecoptera, and Trichoptera Index	Percent composition of Ephemeroptera, Plecoptera, and Trichoptera larvae
	Shannon Diversity Index	Index of diversity based on taxa richness and relative abundance
Tolerance/Intolerance Measures	Tolerance Value	Value between 0 and 10 weighted for abundance of individuals designated as pollution tolerant (higher values) and intolerant (lower values)
	% Dominant Taxa	% individuals in a sample belonging to the dominant taxon

Table 50. Breakpoints for the metrics that make up the Russian River Index of Biological Integrity (CDFG 1999).

Metric	Visual Distribution Score		
	5	3	1
Total Taxa	=36	35-26	<26
Ephemeroptera, Plecoptera, and Trichoptera Taxa	=14	15-39	>39
Ephemeroptera, Plecoptera, and Trichoptera Index	=19	18-12	<12
Shannon Diversity Index	=54	53-17	<17
Tolerance Value	=3.0	2.9-2.3	<2.3
% Dominant Taxa	=3.0	3.1-4.6	>4.6

Data Analysis

We used data from the BLM's reports to examine the biological condition of individual sampling sites at different points in time and gain an understanding of the biological condition of these sampled sites together as a whole. In order to investigate the biological condition of the various sampling sites and how the sites compared to one another, we looked at average index scores for all the samples taken at an individual site on the same day. In order to explore the overall biological condition of the sampling sites, we looked at the assessment categories that the Modified Hilsenhoff Biotic Index, USFS Biotic Condition Index, and Karr and Chu's Index assigned samples to. We were only able to look at the USFS Biotic Condition Index for samples taken in 1999. For our analyses, we examined the index scores of samples taken in the spring or early summer separately from those taken in the fall to circumvent seasonal effects on macroinvertebrate assemblages.

We were also able to use data from PALCO to examine the biological condition of individual sampling sites at different points in time and gain an understanding of the biological condition of these sampled sites together as a whole. In order to investigate of the biological condition of the various sampling sites and how the sites compared to one another, we looked the index scores for each sampling date. In order to explore the overall biological condition of the sampling sites, we looked at the assessment categories that the Hilsenhoff Biotic Index and the RRIBI assigned samples to. We were only able to look at the RRIBI for samples taken in 2000 and 2001. Although PALCO data were collected differently from BLM data, we made some comparisons of the fall values of Simpson's Index and the Hilsenhoff Biotic Index between sites in both data sets.

Results

Values for the Shannon Diversity Index at BLM sites ranged from 2.41 at Thompson Creek in 1999 to 3.31 at the South Fork of Bear Creek at Shelter Cover Road in 2000 in the spring, and 2.47 at Honeydew Creek in 1998 to 3.23 at the South Fork of Bear Creek at Wailaki in 2000 in the fall (Figure 23).

Values for Simpson's Diversity Index at BLM sites ranged from 0.05 at the South Fork of Bear Creek in 2000 to 0.15 at the South Fork of Bear Creek at the confluence with the North Fork of Bear Creek in 1997 in the spring, and 0.06 at the South Fork of Bear Creek at Wailaki in 2000 to 0.19 at Honeydew Creek in 1998 in the fall (Figure 24). Values for Simpson's Diversity Index at PALCO sites ranged from 0.70 at Rodgers Creek in 1995 to 0.94 at Oil Creek in 1994 in the fall (Figure 25).

Values for Evenness at BLM sites ranged from 0.47 at Yew Creek in 1999 to 0.73 at Conklin Creek in 1996 for the spring, and 0.53 at Honeydew Creek in 1998 to 0.74 at the South Fork of Bear Creek at Wailaki in 1998 in the fall (Figure 26).

Values for the Modified Hilsenhoff Biotic Index at BLM sites ranged from 2.69 at the South Fork of Bear Creek at Shelter Cover Road in 2000 to 4.24 at Bridge Creek in 1999 in the spring, and 1.97 at the South Fork of Bear Creek at Shelter Cover Road in 2000 to 4.22 at Bridge Creek in 1997 in the fall (Figure 27). Values for the Modified Hilsenhoff Biotic Index at PALCO sites ranged from 2.85 at Sulphur Creek in 2001 to 5.07 at Alwardt Creek in 1998 in the fall (Figure 28). An unmodified Hilsenhoff Biotic Index was calculated prior to 1997 and these index values are lower.

Values for the USFS Biotic Condition Index at BLM sites in 1999 ranged from 65.33 for Thompson Creek to 83.33 for Bridge Creek in the spring, and 74.33 at the Mattole River at Pipe Creek to 91 at Thompson Creek in the fall (Figure 29).

Values for Karr and Chu's Index at BLM sites ranged from 17.33 at Thompson Creek in 1999 to 49.50 at the South Fork of Bear Creek at Shelter Cover Road in 2000 in the spring, and 30 at Honeydew Creek in 1998 to 48 at the West Fork of Mill Creek (R.M. 2.8) in 2000 in the fall (Figure 30).

Values for the RRIBI at PALCO sites ranged from 12 for Alwardt Creek in 2000 to 24 for Rodgers Creek in 2000 (Figure 31).

The Hilsenhoff Biotic Index at BLM and PALCO sites indicated slight organic enrichment in most sites in both the spring and the fall (Figure 32). One sample in the spring (Bridge Creek in 1997) and eight samples in the fall (Yew Creek in 1999, Conklin Creek in 1996, Bridge Creek in 1999, Alwardt Creek in 1998 and 2000, Rodgers Creek in 1998, Sulphur Creek in 1998, and the Upper North Fork Mattole River in 2000) showed indications of enriched conditions. The USFS Biotic Condition Index at BLM sites indicated that most sites were in fair or good condition in both the spring and the fall (Figure 33). Two samples in the fall (Thompson Creek and the Mattole River at Stanley Creek) showed indications of poor conditions. Karr and Chu's Index at BLM sites indicated that most sites were non-impaired or slightly impaired in both the spring and the fall (Figure 34). This index also showed indications of moderated impaired conditions for Thompson Creek and the Mattole River at Stanley Creek for the fall of 1999. Lastly, the RRIBI at PALCO sites indicated that most sites were in good biotic condition (Figure 35).

Discussion

Based on the various indices calculated by the BLM, the overall biological condition of the 21 streams sampled in the Mattole Basin is good. All streams sampled by the BLM exhibited similar diversities and evenness values for their macroinvertebrate assemblages and most streams sampled by both the BLM and PALCO had values for the Hilsenhoff Biotic Index, USFS Biotic Index, Karr and Chu's Index, and the RRIBI that indicate fair to good, or good levels of biological condition (Table 51).

Table 51. Overall biological condition of streams in the Mattole Basin based on biotic indices.

E is excellent, G is good, F is fair and P is poor. Hilsenhoff Biotic Index (HBI) indications of clean were coded as excellent, slightly enriched as good, enriched as good, enriched as fair and polluted as poor. Karr and Chu index indications of non-impaired were coded as excellent, slightly impaired as good, moderately impaired as fair and severely impaired as poor.

Creek	Subbasin	HBI	USFS BCI	Karr & Chu Index	RRIBI	Overall Conditions
Alwardt Creek	Northern	F, G			F	Fair to Good
Rodgers Creek	Northern	F, G			E	Good
Sulphur Creek	Northern	F, G			G	Fair to Good
Conklin Creek	Northern	F		G		Fair to Good
Upper North Fork Mattole River	Northern	F, G			G	Fair to Good
Oil Creek	Northern	Undetermined				Undetermined
Green Ridge Creek	Northern	Undetermined				Undetermined
Rattlesnake Creek	Northern	Undetermined				Undetermined
Bridge Creek	Southern	F,G	G	G, E		Good
Mattole River at Stanley Creek	Southern	G	P, G	F, G		Fair to Good
Baker Creek	Southern	G	E	G		Good to Excellent
Thompson Creek	Southern	G, E	P, E	F, G		Fair to Good
Yew Creek	Southern	F, G	F	G, E		Fair to Good
Mattole River at Pipe Creek	Southern	G	F	E		Good
Mill Creek (R.M. 2.8)	Western	G		G		Good
West Fork of Mill Creek (R.M. 2.8)	Western	G	F	G, E		Good
Honeydew Creek	Western	G		G		Good
North Fork of Bear Creek	Western	G		G		Good
South Fork of Bear Creek at Confluence	Western	G		G		Good
South Fork of Bear Creek at Shelter Cover Road	Western	G	G, F	G, E		Good
South Fork of Bear Creek at Wailaki	Western	G	F, G	G, E		Good

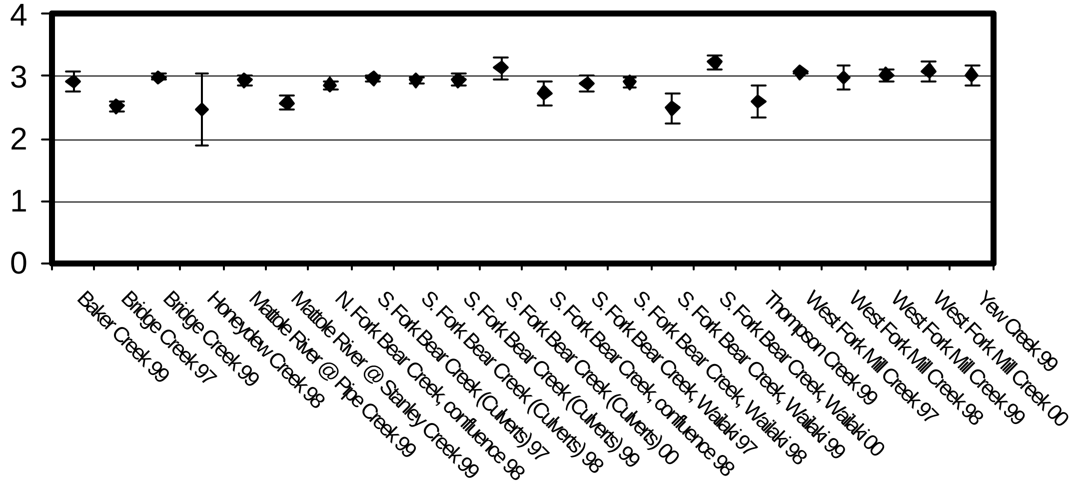
Index scores in the South Fork of Bear Creek at the confluence with the North Fork of Bear Creek, Honeydew Creek, the North Fork of Bear Creek, and Mill Creek (R.M. 2.8), consistently indicated good conditions, while index scores in Baker Creek indicated good to excellent conditions. Index scores in Bridge Creek, the Mattole River at Pipe Creek, the South Fork of Bear Creek at Wailaki, the South Fork of Bear Creek at Shelter Cover Road, Rodgers Creek, and the West Fork of Mill Creek (R.M. 2.8) varied slightly but indicated good conditions overall. Index scores in the Mattole River at Stanley Creek, Thompson Creek, Yew Creek, Alwardt Creek, Sulphur Creek, the Upper North Fork Mattole River, and Conklin Creek also varied but indicated fair to good conditions overall. In terms of subbasins, these results show streams in the Northern Subbasin to vary from fair to good, to good condition; streams in the Southern Subbasin to vary from fair to good, to good to excellent condition; and streams in the Western Subbasin to be in good condition.

A closer examination of individual samples showed eight samples with signs of organic enrichment based on the Hilsenhoff Biotic Index. None of these samples had any other indications of impairment based on other biotic indices. Bridge Creek showed signs of enrichment in two of the four samples taken there – one in the spring of 1997 and one in the fall of 1999, whereas Yew Creek only showed signs of enrichment in one of the three samples collected there. Conklin Creek was only sampled on one date. Rodgers and Sulphur Creeks showed signs of enrichment in 1998, the Upper Fork of the Mattole River showed signs of enrichment in 2000, and Alwardt Creek showed signs of enrichment in both 1998 and 2000,

Two samples were also indicated in poor condition by the USFS Biotic Condition Index and moderately impaired by Karr and Chu's Index. These were Thompson Creek and the Mattole River at Stanley Creek in the fall of 1999. Thompson Creek was also sampled in the spring of 1999 when it was indicated to be in excellent condition by the USFS Biotic Condition Index and slightly impaired by Karr and Chu's Index. The Mattole River at Stanley Creek was also sampled in the spring of 1999 when it was indicated to be in good condition by the USFS Biotic Condition Index and slightly impaired by Karr and Chu's Index. Looking at the component metrics of Karr and Chu's Index, both Thompson Creek and the Mattole River at Stanley Creek scored low for the number of Ephemeroptera taxa and the number of intolerant taxa, possibly indicating problems with stream temperatures and enrichment.

The biological condition of a stream as indicated by macroinvertebrate assemblages is also an important indicator of the biological condition for fish populations. Both macroinvertebrates and fish live in the stream and are affected by variations in stream temperature, sediment, flow, and nutrients. Native salmonid populations are especially sensitive to increased stream temperatures and sediment, which can be detected by changes in macroinvertebrate assemblages such as decreased numbers of Ephemeroptera, Plecoptera and tolerant species. Therefore, the indications of good biological condition overall in the Mattole Basin based on macroinvertebrates are a good sign for native salmonid populations. However, the fact that several streams may have indications of seasonal organic enrichment or other impairments identifies potential trouble spots. Indications of organic enrichment in Bridge Creek, Yew Creek, Conklin Creek, Alwardt Creek, Rodgers Creek, Sulphur Creek, and the Upper North Fork Mattole River, and decreased numbers of macroinvertebrates that are intolerant to pollution and high temperatures in Thompson Creek and the Mattole River at Stanley Creek identify potential temperature and enrichment problems for salmonids.

Spring



Fall

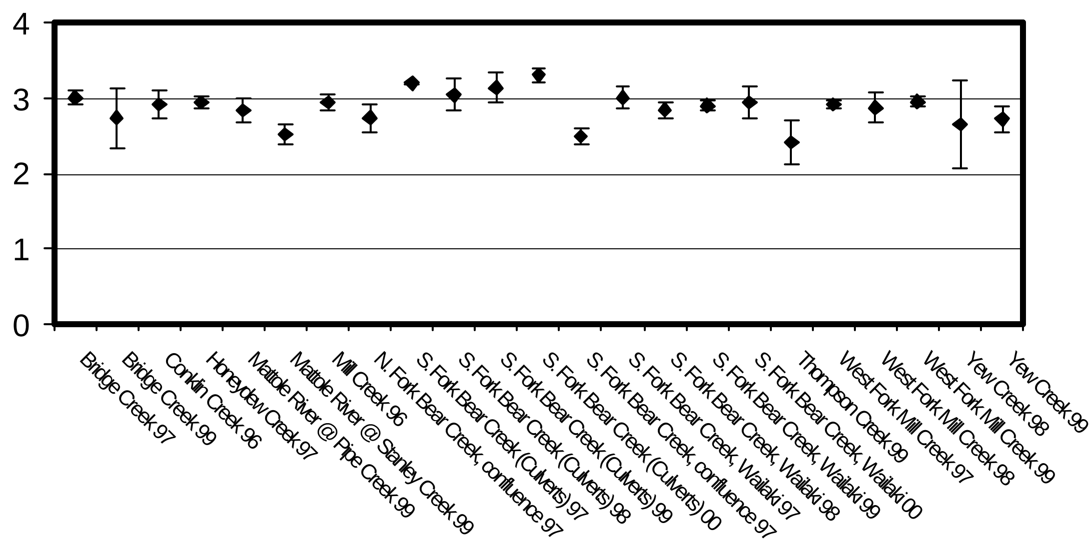
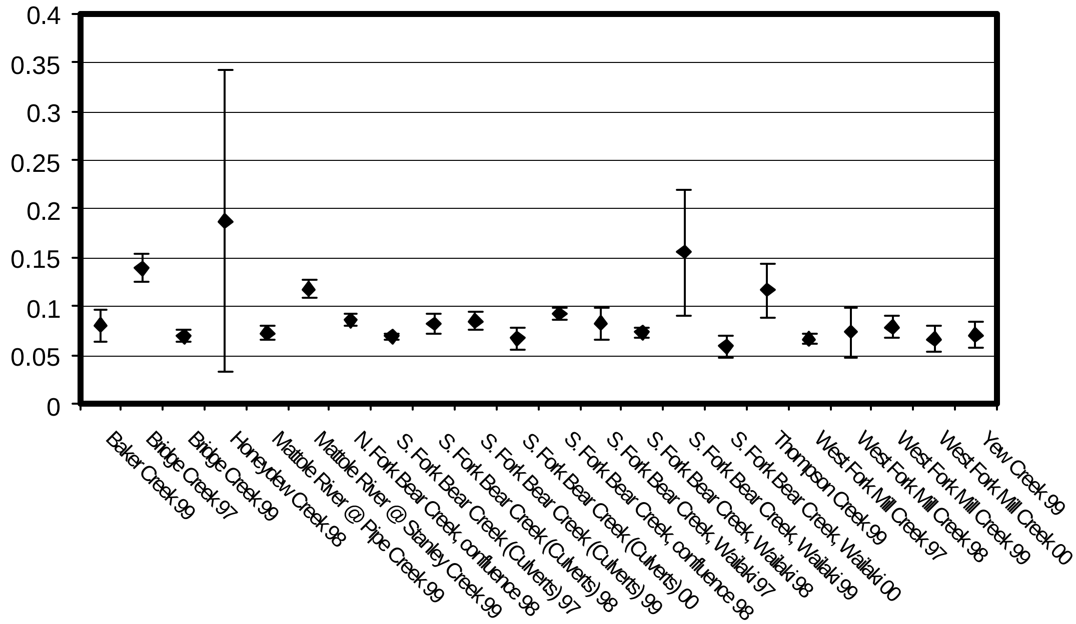


Figure 23. Shannon Diversity Index values for samples taken by BLM in the spring and the fall. High values indicate high diversity.

Error bars are standard deviations.

Spring



Fall

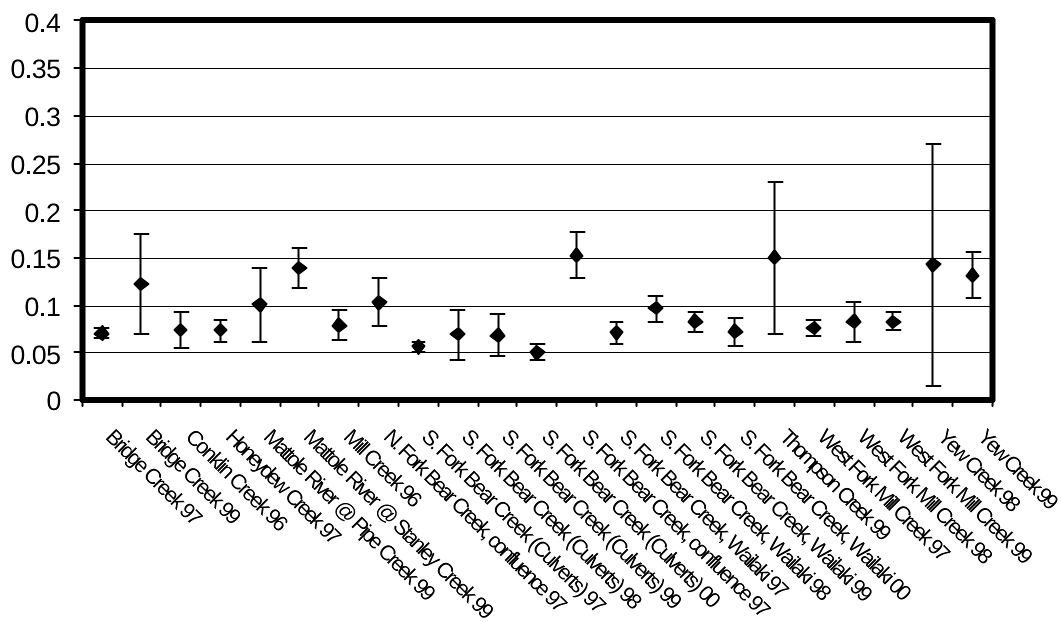


Figure 24. Simpson's Diversity Index values for samples taken by BLM in the spring and the fall.

Values range from 0 (low diversity) to 1-1/S (high diversity) where S is the number of taxa. Error bars are standard deviations.

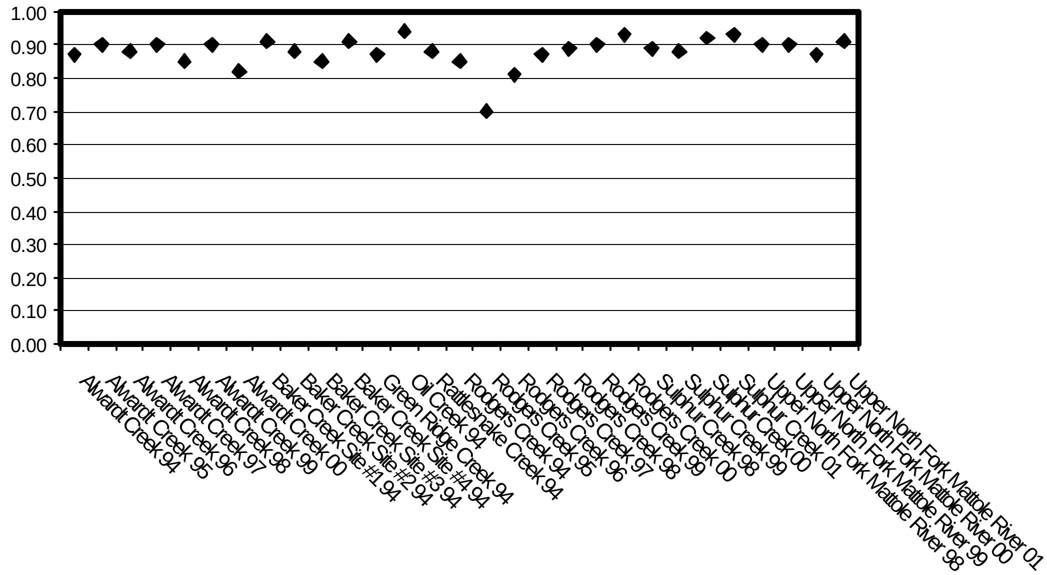
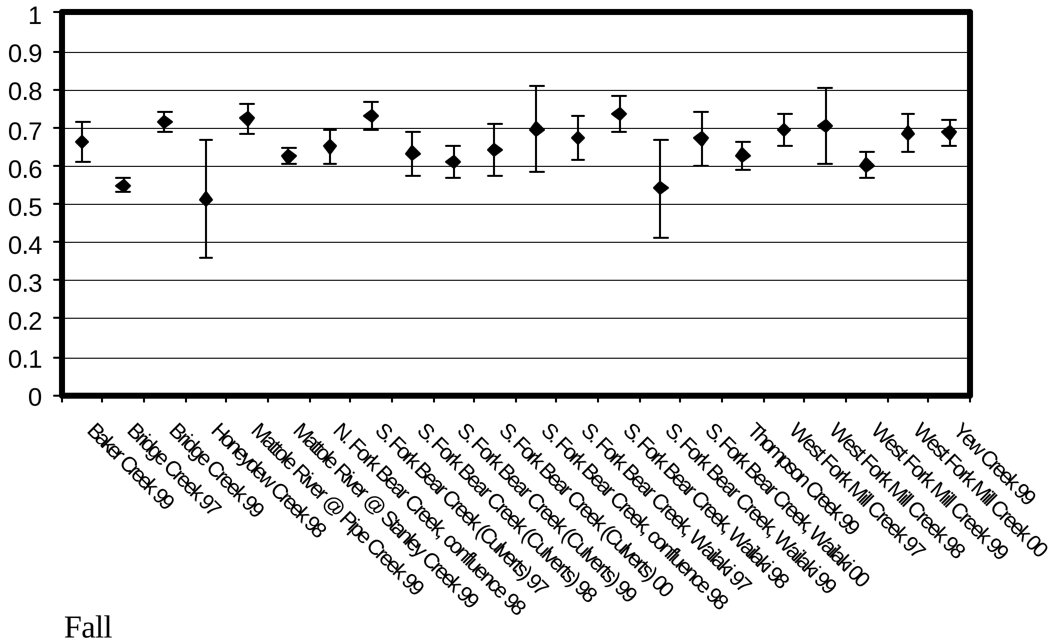


Figure 25. Simpson's Diversity Index values for samples taken by PALCO in the fall.

PALCO calculated Simpson's Index differently that the BLM. Values from 0.90 – 1.00 indicate good conditions, 0.70 – 0.79 indicate average conditions, and 0.70 – 0.79 indicate poor conditions.

Spring



Fall

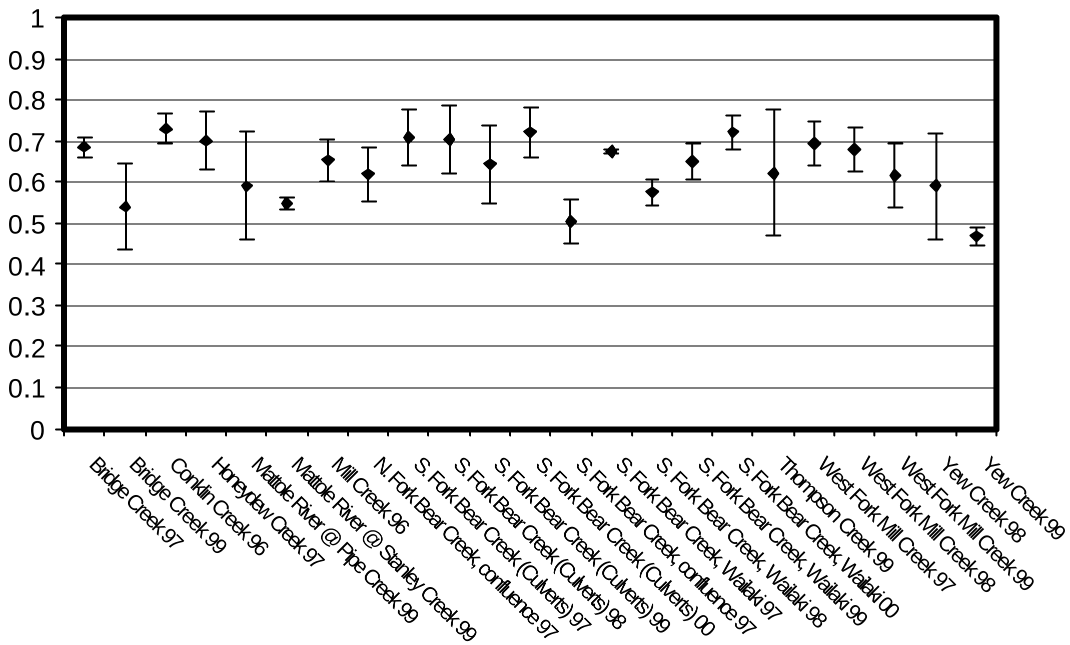
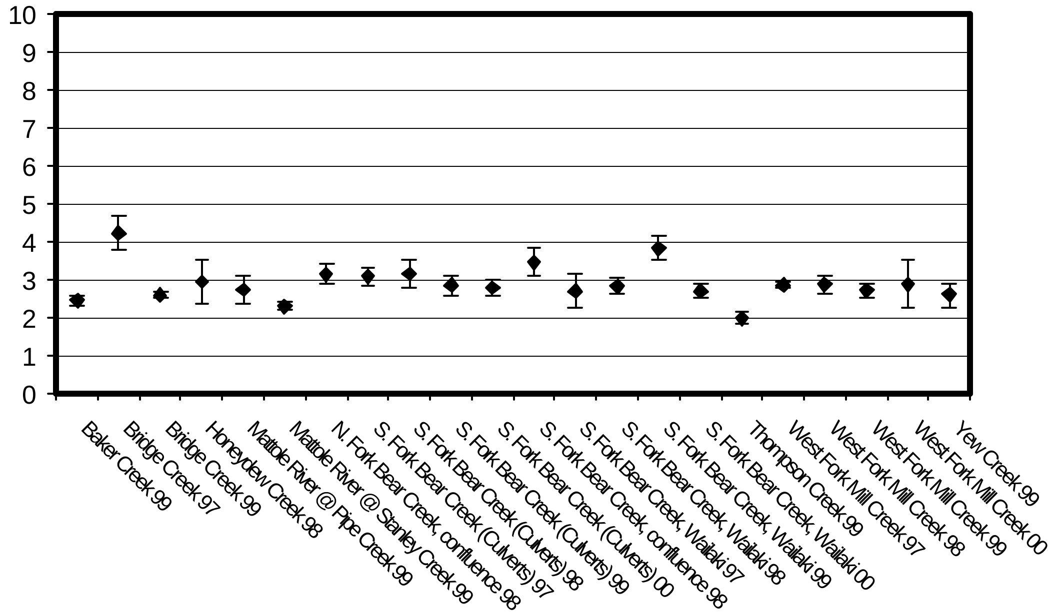


Figure 26. Evenness values for samples taken by BLM in the spring and the fall.

Values range from 0 to 1 (high single taxon dominance) where S is the number of taxa. Error bars are standard deviations.

Spring



Fall

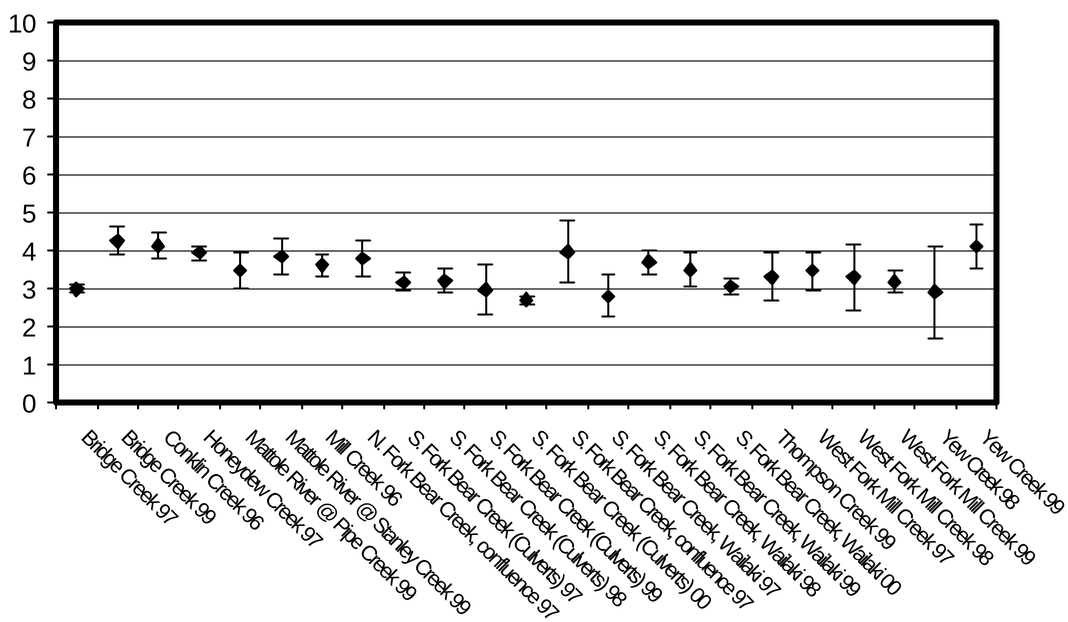


Figure 27. Hilsenhoff Biotic Index values for samples taken by BLM in the spring and the fall.

Values from 0-2 indicate clean conditions, 2-4 indicate slightly enriched conditions, 4-7 indicate enriched conditions and 7-10 indicate polluted conditions. Error bars are standard deviations.

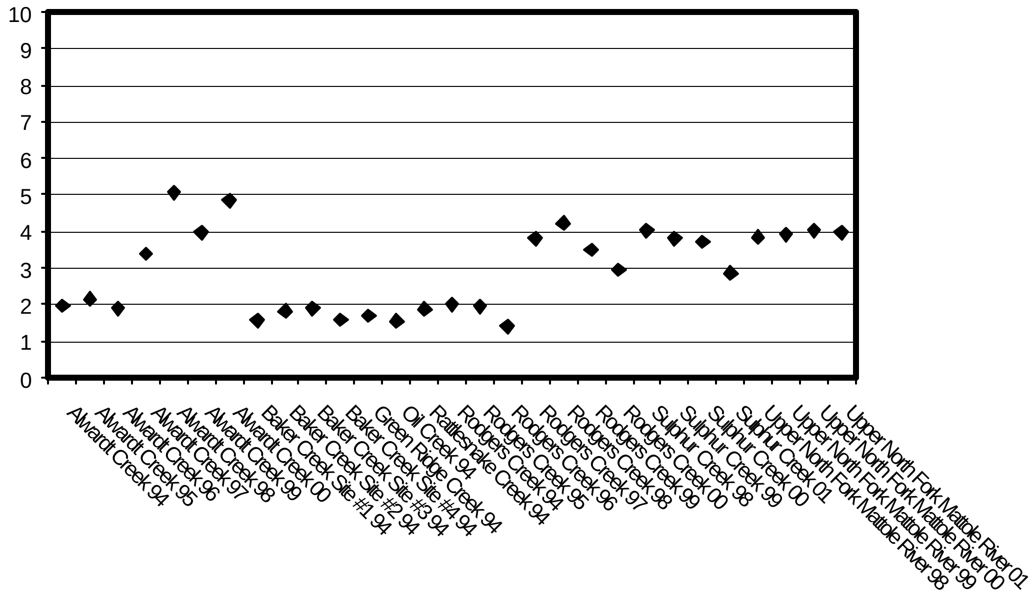
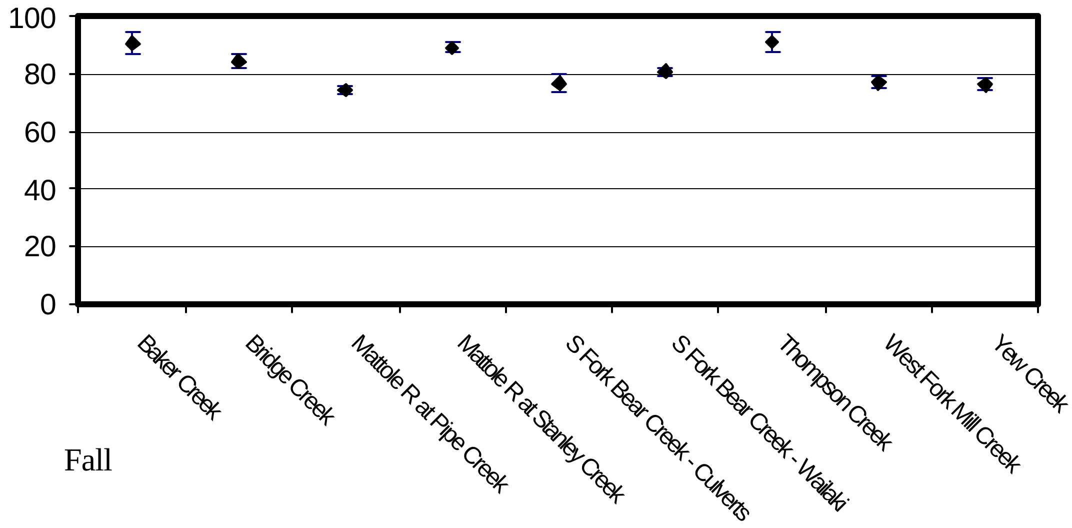


Figure 28. Hilsenhoff Biotic Index values for samples taken by PALCO in the fall.

Spring



Fall

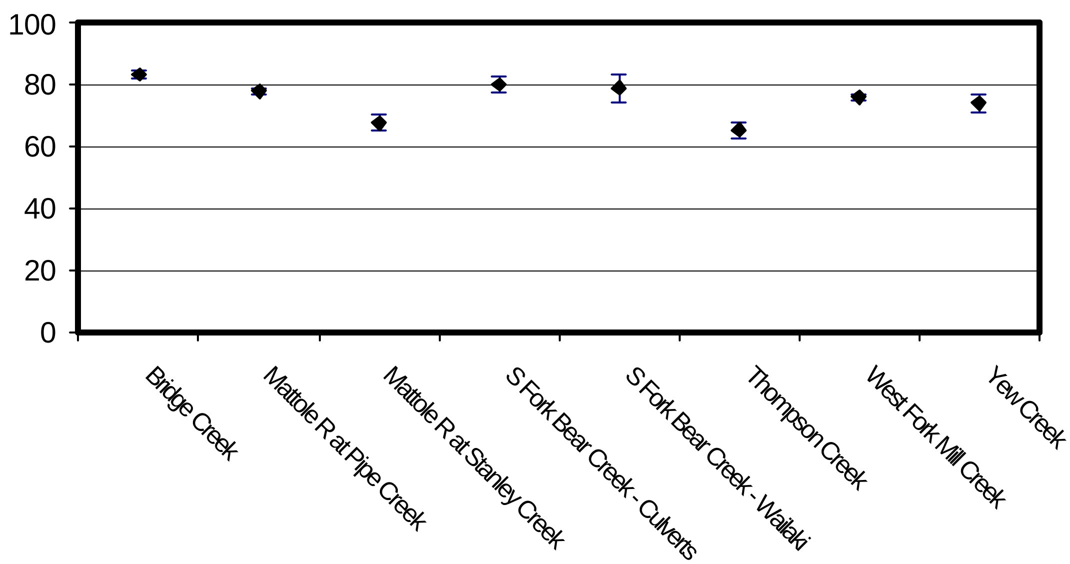
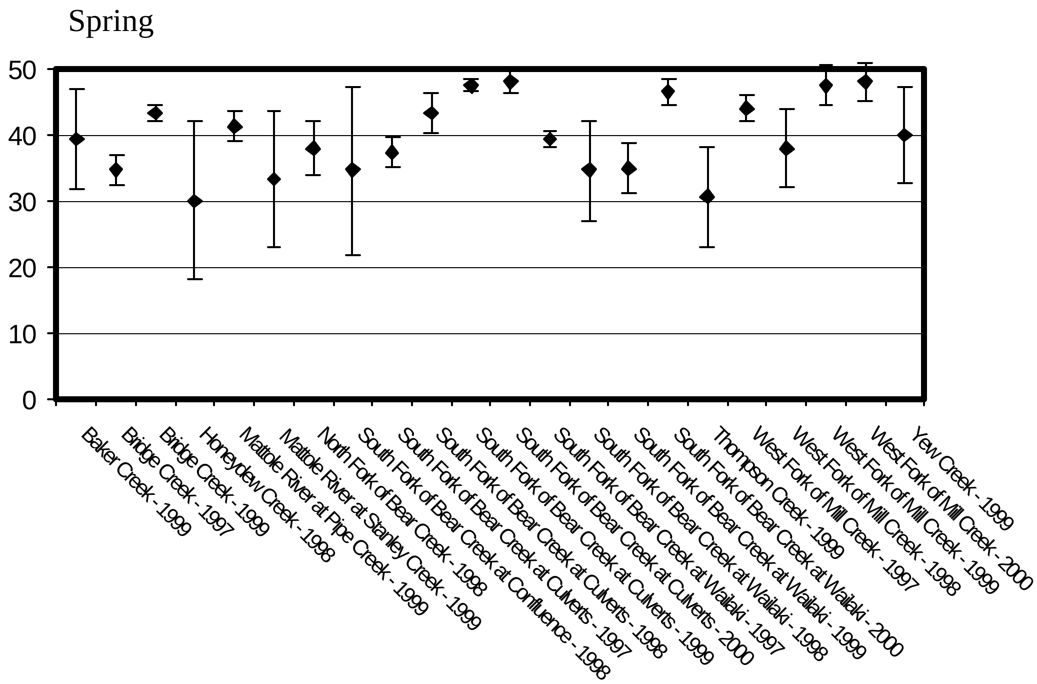


Figure 29. USFS Biotic Condition Index values for samples taken by the BLM in the spring and the fall of 1999.

Values >90 indicate excellent conditions, 80-90 indicate good conditions, 72-79 indicate fair conditions and <72 indicate poor conditions. Error bars are standard deviations.



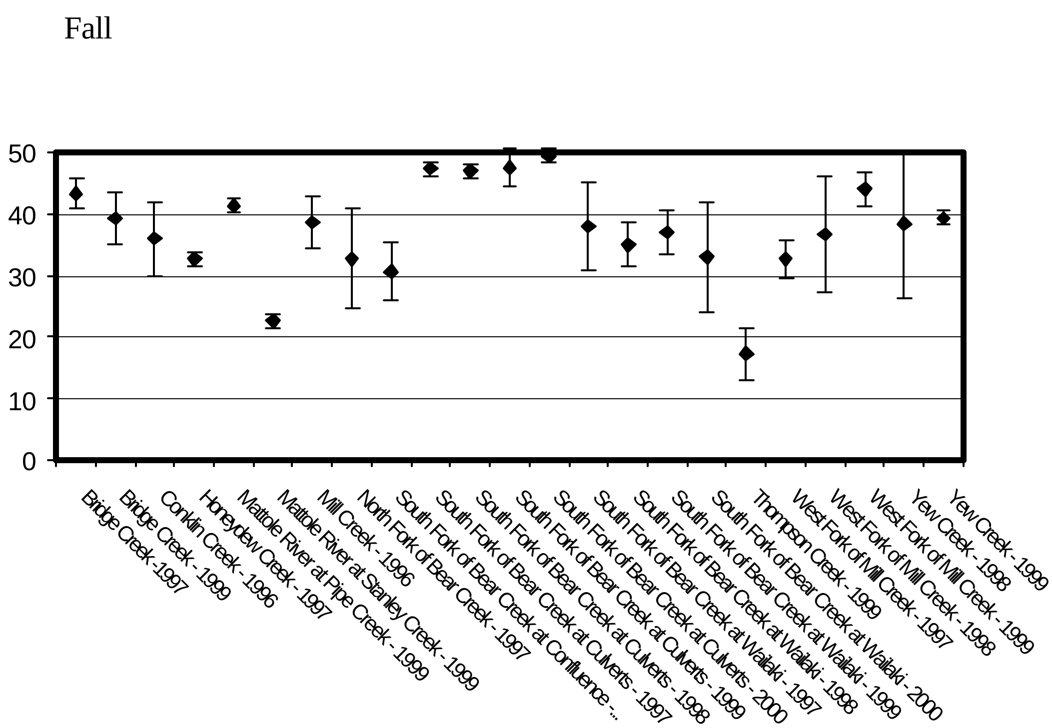


Figure 30. Karr and Chu's Index values for samples taken by the BLM in the spring and the fall of 1999.

Values >40 indicate non-impaired conditions, 25-39 indicate slightly impaired conditions, 12.5-24 indicate moderately impaired conditions and <12.5 indicate severely impaired conditions, 12.5-24 indicate moderately impaired conditions and <12.5 indicate severely impaired conditions. Error bars are standard deviations.

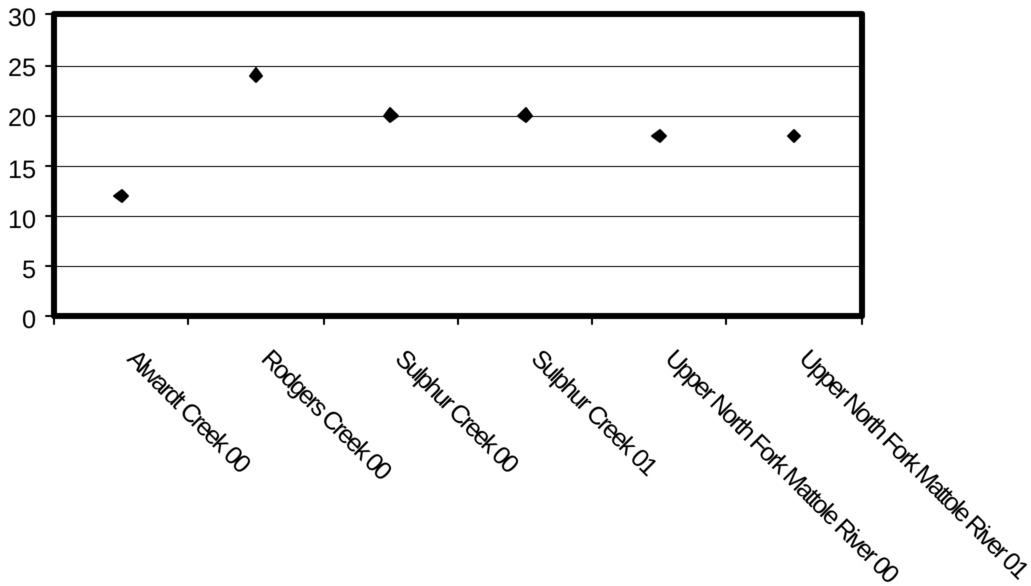
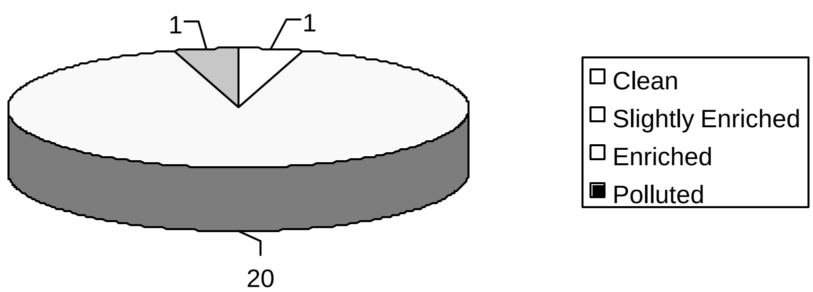


Figure 31. Russian River Index of Biological Integrity values for samples taken by PALCO in 2000 and 2001.

Values >24 indicate excellent biotic conditions, 18-23 indicate good conditions, 12-17 indicate fair conditions and 6-11 indicate poor conditions.

Spring



Fall

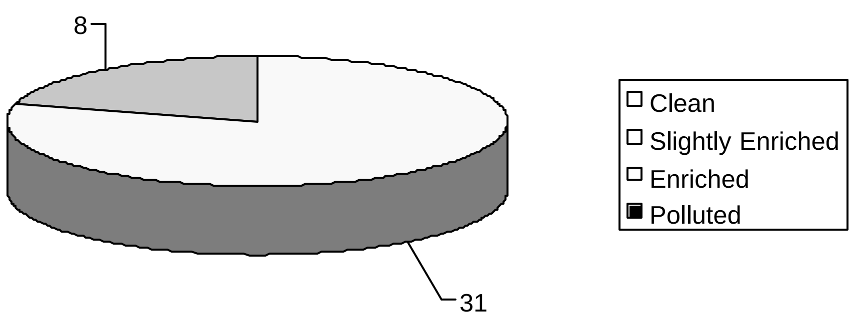


Figure 32. Distribution of average assessment categories assigned by examining values for Modified Hilsenhoff's Biotic Index for spring macroinvertebrate samples taken by the BLM and fall macroinvertebrate samples taken by the BLM and PALCO (after 1996) in the Mattole Basin.

Numbers indicate the number of samples in an assessment category.

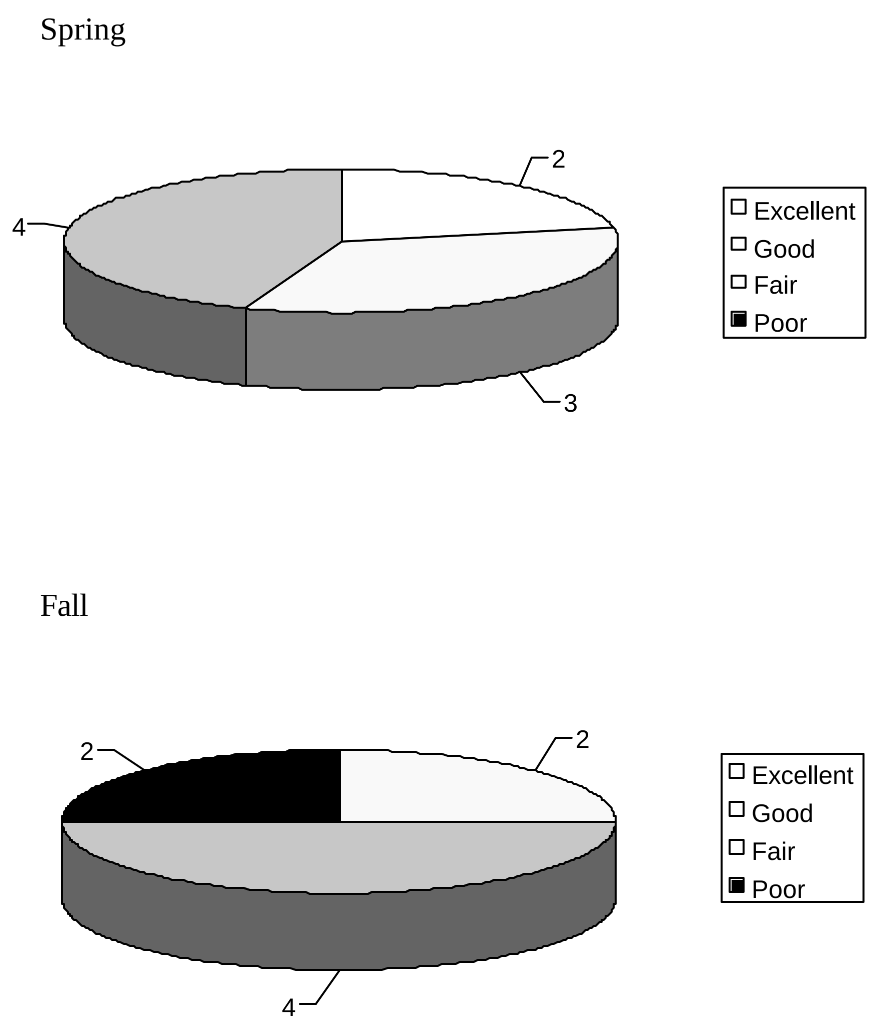
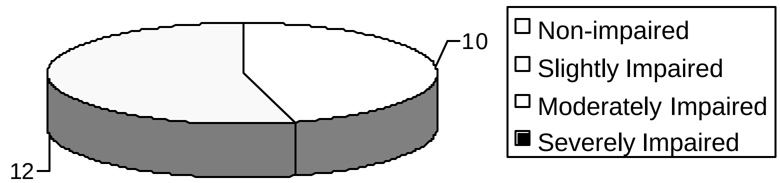


Figure 33. Distribution of average assessment categories assigned by examining values for the USFS Biotic Condition Index for spring and fall of 1999 macroinvertebrate samples taken by the BLM in the Mattole Basin.

Numbers indicate the number of samples in an assessment category.

Spring



Fall

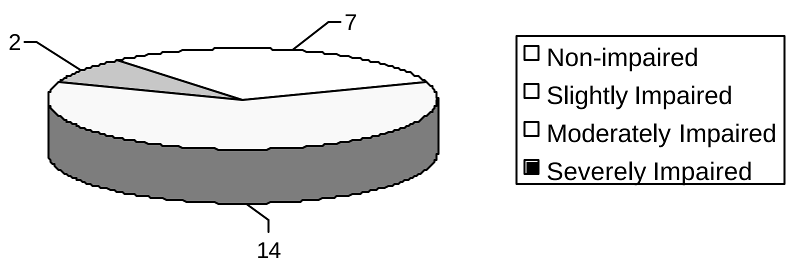


Figure 34. Distribution of average assessment categories assigned by examining values for Karr and Chu's Index for spring and fall macroinvertebrate samples taken by the BLM in the Mattole Basin.

Numbers indicate the number of samples in an assessment category.

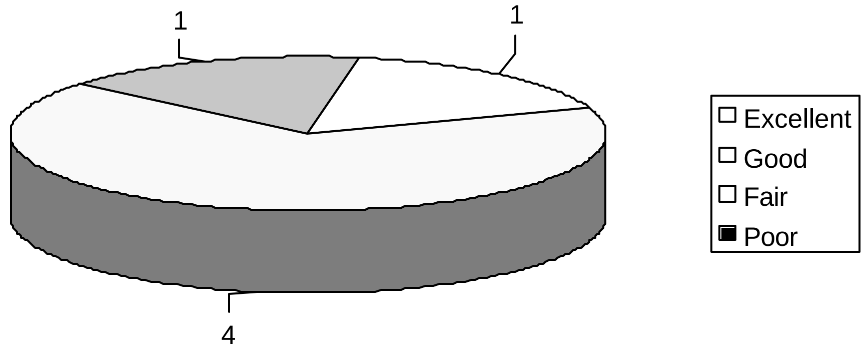


Figure 35. Distribution of average assessment categories assigned by examining values for the Russian River Index of Biological Integrity for fall macroinvertebrate samples taken by PALCO in the Mattole Basin in 2000 and 2001.

Numbers indicate the number of samples in an assessment category

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